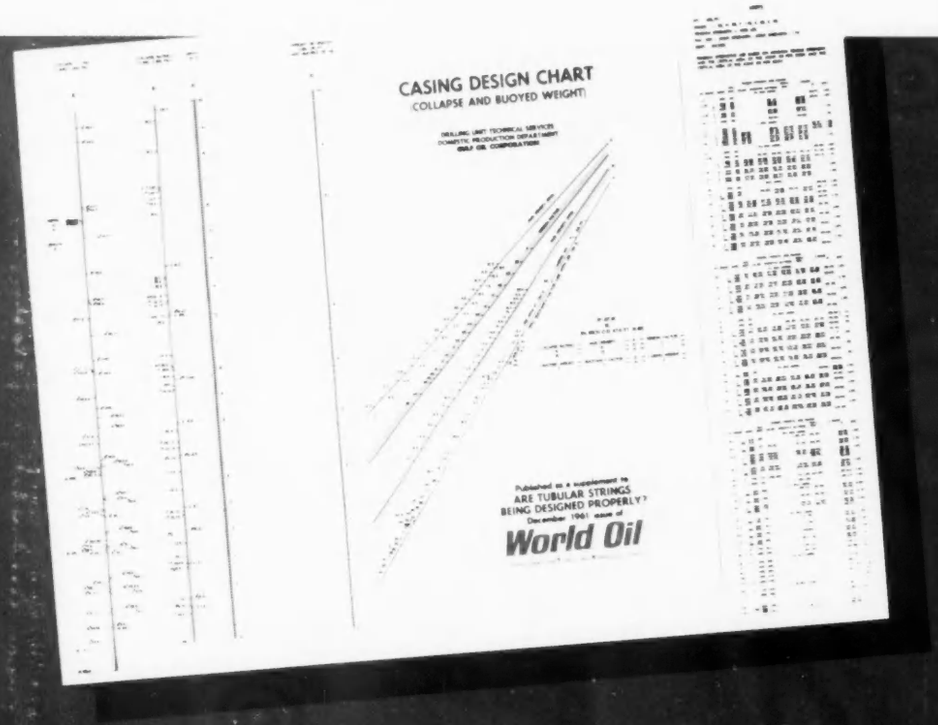
DECEMBER 1961

World Oil

EXPLORATION • DRILLING • PRODUCTION

UNIVERSITY OF MICHIGAN
DEC 18 1961
SCIENCE LIBRARY



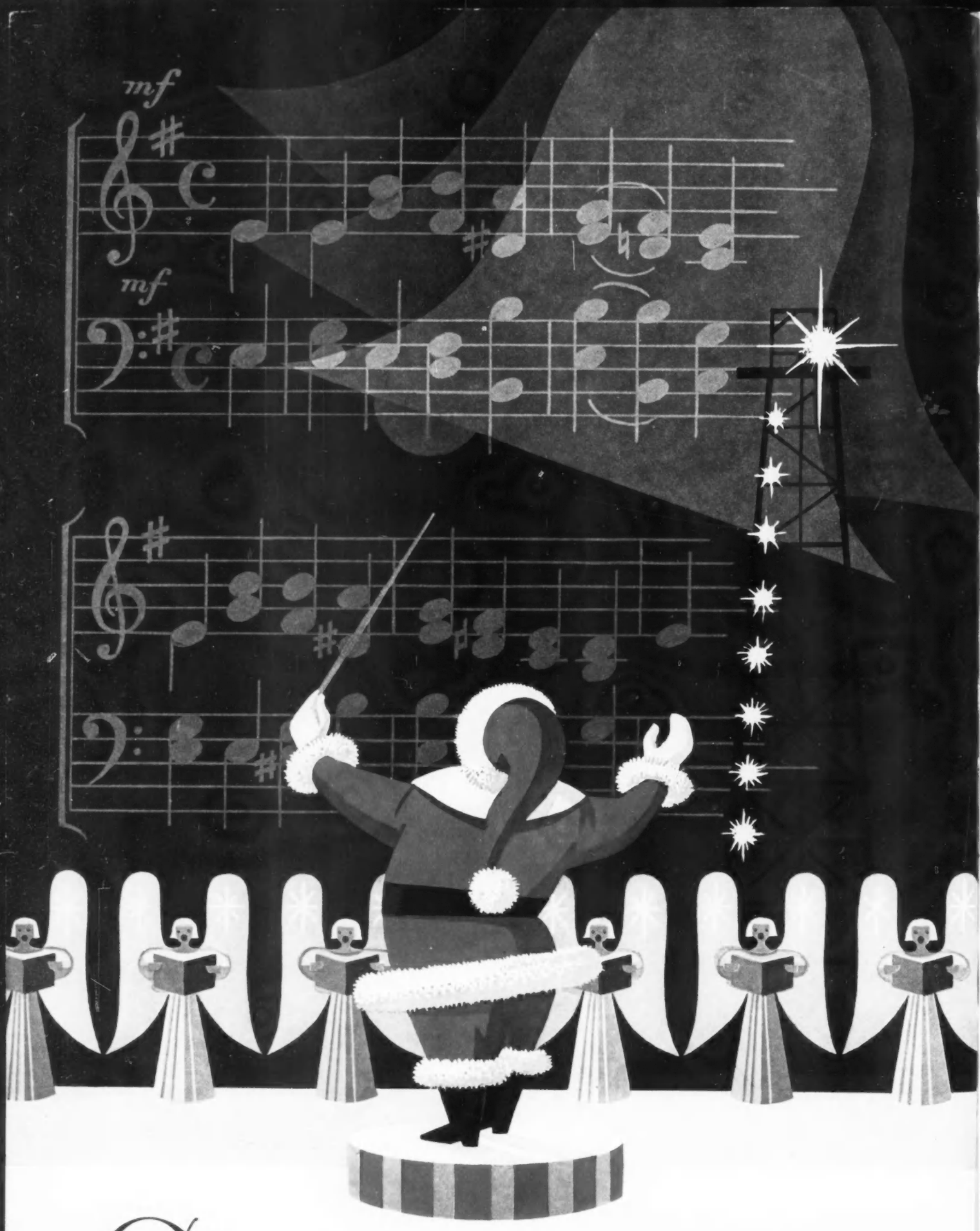
TUBULAR STRING DESIGN GUIDE CAN SAVE YOU TIME AND MONEY

This desk-sized, working nomograph published as a supplement in this issue

PAGE 92

Oil men take a look at 1962 13
Vapor recovery in the Rockies 89
How to remove diurnal effects 107
Slim holes can cut costs 116

SUBSCRIPTION PRICE $2 PER YEAR • SINGLE COPY PRICE 50 CENTS



Greetings from **Halliburton**
COMPANY · DUNCAN, OKLAHOMA

World Oil

Established 1916 as The OIL WEEKLY®

A Gulf Publishing Company Publication

FOR EXPLORATION, DRILLING AND PRODUCING ENGINEERING OPERATIONS AND MANAGEMENT

"He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine receives light without darkening me."
—Thomas Jefferson.

VOL. 153, NO. 7 DECEMBER 1961

EXPLORATION

Aeromagnetics develop new prospects and techniques (Part 4)
W. P. Jenny 105

How to determine and remove diurnal effects precisely
H. Wayne Hoylman 107

DRILLING

Are tubular strings being designed properly? (Part 2)
T. B. O'Brien and W. C. Goins, Jr. 92

Modified slim hole program cuts costs
H. J. Flatt 116

PRODUCTION

Stock tank vapor recovery pays off in the Rockies
T. R. Blevins and F. G. Van Matre 89

New method for estimating primary oil reserves
Dr. William F. Stevens and Dr. George Thodos 113

ENGINEERING PRACTICES REPORT

Small diameter well completions (Part 5: Wellheads)
R. W. Scott 102

CURRENT OUTLOOK

Independent oil men look at '62
Don E. Lambert 13

Good demand in October encouraging 24

Drilling goes ahead of 1960 in October 28

Merging fields may create nation's No. 2 gas reserve
Curtis Stevens 120

DEPARTMENTS

Quick look at this issue 3
Editorial page 9
Looking ahead 11
An interpretive look at what's happening 13
Changing panorama 24
Drilling activities 28
Practical operating hints 44
Men in the industry 126
Associations 135
Who's meeting where 140
Suppliers' notes 142
Squeaks from bullwheel 148
Trading Post 152
Classified advertising 152
New equipment 156
New literature 168
Advertisers' Index 170

WORLD OIL published every month except semi-monthly in February and August. Second class postage paid at Houston, Texas.

©Gulf Publishing Co. 1961.

QUICK LOOK at this issue

Independent oil men look at '62

What are the major challenges that lie ahead during the next 12 months? What is the current status of the industry? How do top industry and government leaders view the independents' future? These and other key problems brought before the 32nd annual meeting of the Independent Petroleum Association of America are discussed in detail in WORLD OIL's Interpretive Look at the three-day session, starting on **Page 13.**

Monthly income increased $30,000

Continental Oil Company has increased monthly income approximately $30,000 by installing vapor recovery systems on five Denver-Julesburg Basin tank batteries. This article outlines Conoco's experience with installations and points out important operating factors which should be considered before installing similar systems ..... **Page 89**

New nomograph for casing design

This second part of a two-part series discusses the practical aspects of casing design. The first part was published in the November issue of WORLD OIL. Actual examples are shown and evaluated. Two design approaches are presented—the present standard method and the new nomograph approach. The new desk-sized, color nomograph is included as a supplement to this issue. Don't miss it! ..... **Page 92**

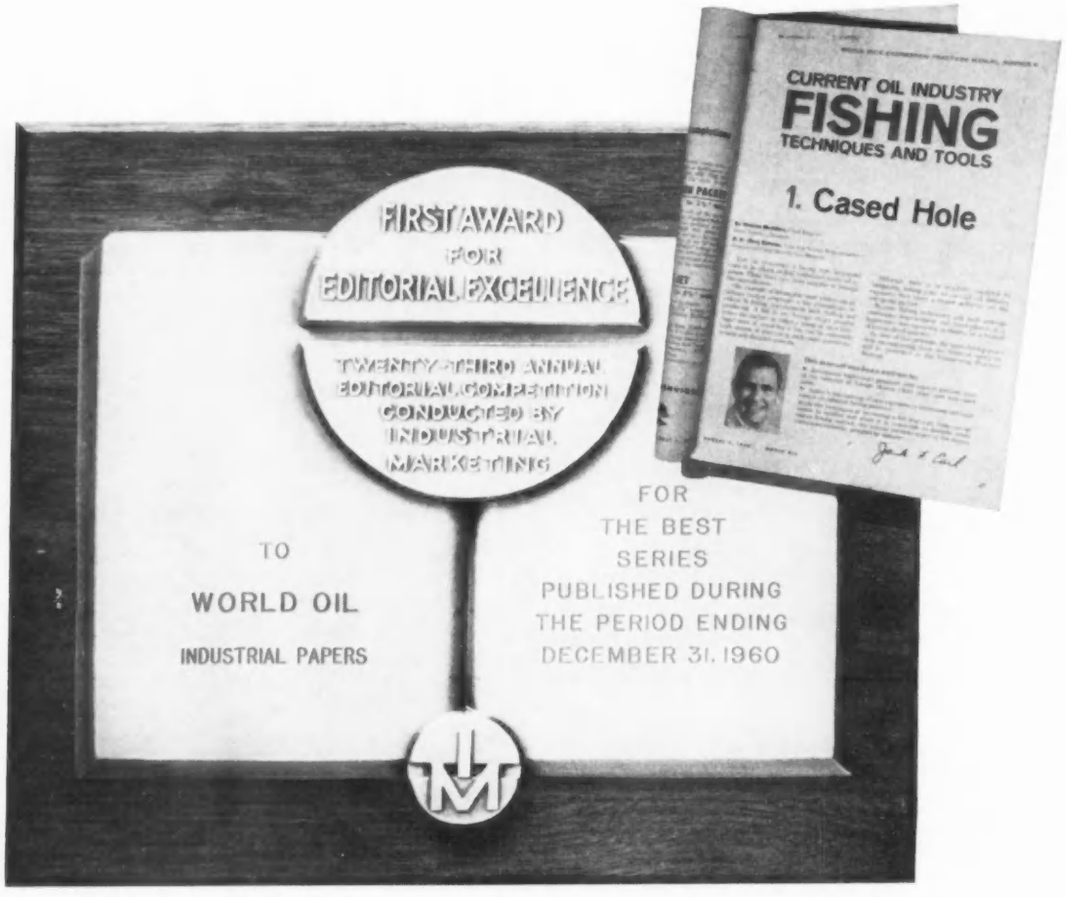
Another Engineering Practices Report

Casing head equipment for small diameter wells has evolved from tubing heads developed originally for conventional completions. This fifth installment of Engineering Practices Report No. 4 shows general types now in use. Equipment for single through quadruple string installations is discussed ..... **Page 102**

What aeromagnetics can do

Experience shows that through careful, correct micromagnetic interpretation, accuracy gained by slower, more painstaking ground magnetic methods can be duplicated by aeromagnetics. This is possible even in cases of highly localized prospects. But care is required to avoid losing significant local micromagnetic details in the more abundant regional data available in aerial surveys... **Page 105**

Continued on Page 5



WORLD OIL WINS NATIONAL HONOR

World Oil has been awarded an editorial honor that both the management and staff would like to share with you—our subscriber.

This honor is the first place award for the Best Series of Articles in the industrial publication classification of *Industrial Marketing's* annual Editorial Achievement Competition for Business Publications.

Industrial Marketing is a leading national magazine in its field. Its reading matter is directed to the interests of industrial advertising, selling and marketing. For 23 years, *Industrial Marketing* has been conducting the Editorial Achievement Competition, the objective of which is to acknowledge and encourage high editorial standards among businesspapers.

World Oil's entry in this nation-wide competition was the two-part series titled "Fishing—Current Oil Industry Techniques and Tools," which appeared in the August 1 and September, 1960, issues. Edited by Engineering Editor Jack F. Earl, who received the First Place Plaque in behalf of the World Oil Editorial Department on November 30 at the award luncheon at the Waldorf-Astoria hotel, New York City, the award-winning editorial presentation was written to:

► **Re-acquaint supervisory personnel with current methods used in the recovery of foreign objects from open and cased holes.**

► **Assist in the training of new engineers in techniques and tools used in oil industry fishing problems.**

While the techniques of recovering a fish may vary from one operator to another and while it is impossible to describe every known fishing method, this second World Oil Engineering Practices Report contains many of the proven techniques currently accepted by industry.

Entries in the 1960 competition totaled almost 300 in all classifications. Entries were received from the leading businesspapers throughout the United States. Judging was done by 30 experienced industrial men.

"We feel that the competition this year was more meaningful than ever before," said Sid Bernstein, *Industrial Marketing* editorial director. "Those who won awards at our annual presentation luncheon have even more reason than ever to be proud of the quality of their editorial achievements."

The World Oil staff is extremely proud to have recognized and met the long-standing industry need for such an authoritative and detailed presentation. This need was evidenced by the immediate and enthusiastic response to the first part of this series. Orders began arriving for the complete report even before Part 2 was published.

If you do not have your own copy of the complete Fishing Practices Report or if you are one of our new subscribers and have not seen the award-winning presentation, you may want to order from the limited remaining supply of the complete report. Cost is $1 a copy. Please send your order and remittance to Reprint Department, World Oil, P. O. Box 2608, Houston, Texas.

Diurnal effects can be discounted

Diurnal variations in the earth's magnetic field have been a disruptive influence in the past on magnetic and telluric exploration for oil and gas, as well as being a factor in navigation. Recently developed techniques using the proton-free precision magnetometer in base stations for recording diurnals during aeromagnetic surveys make possible reliability and repeatability equivalent to instrument sensitivity. For details and actual survey results, turn to .....Page 107

New way to estimate primary reserves

A direct approach for estimation of primary oil reserves provides results comparable to those obtained with more involved methods. The procedure requires few calculations and makes possible the extrapolation of available production data without the need for an assumed type of decline.....Page 113

Slim holes, fat savings in Paradox

Humble Oil & Refining Company has reported a savings of $39,000 on a six-well modified slim hole drilling program in the Paradox Basin of Utah. The savings are attributed to proper rig selection, use of larger pumps for optimum rig hydraulics, awarding of multi-well contracts, maintaining closer operator supervision and closer observance of the detailed drilling design procedures. For the results of this program, turn to.....Page 116

Nation's second largest gas reserve?

Because of the great size and complexity of the fast-developing Texas-Oklahoma Panhandle, southwest Kansas, southeast Colorado area, no one yet has found the time or data necessary to evaluate the region properly. Here is the first comprehensive report to show how steady oil and gas field growth, plus merging of adjacent fields, is gradually forcing a new "field" concept for the 160 by 100-mile area. For complete details on this active area, including valuable lease and farmout information, turn to **Page 120**.

And in January . . . something new

You have read general views of industry leaders concerning the year ahead—more times than you can remember. **But, you never have seen a cross-comparison of oil leaders, representing:**

- Companies with U.S. and overseas operations
- Companies with U.S. operations only
- Drilling contractors
- Equipment manufacturers and suppliers

This completely new approach to industry forecasting, representing a survey of nearly 500 oil leaders, will be yours for the reading in January WORLD OIL.

Oil Industry In Brief

Here are the latest industry trends revealed by WORLD OIL and industry research:

Equipment sales up. Survey of 20 largest oil equipment companies reveals sales totaled $518.8 million during first three quarters of '61—up $6 million over same '60 period.

Demand increases. October petroleum demand was substantially better than year ago. Gasoline demand was up 1.9 percent; distillate, up 6 percent; kerosine, up 14.8 percent. Demand for all oils was up 1.6 percent for first 10 months, may be up 2 percent for the year . . . See Page 24.

October runs improve. Crude runs to stills averaged 8.2 million barrels daily, up 3.5 percent from same '60 period, while domestic crude production increased 2.6 percent . . . See Page 24.

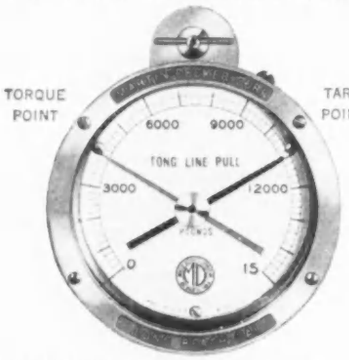
Imports up sharply. During first 10 months, imports averaged 1.9 million barrels daily, up 4.2 percent over '60. In meantime, domestic crude production increased only 2.4 percent and natural gas liquids production increased 5.2 percent . . . See Page 24.

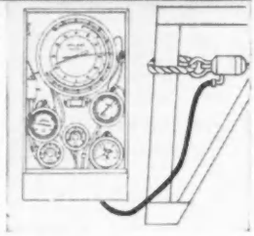
Drilling improves. New well completions totaled 4,279 in October, up 95 wells or 2.3 percent over last year. Footage drilled was up 5.6 percent. However, completions for first 10 months totaled 37,268, down 1,412 wells or 3.7 percent from 1960. Footage drilled was down 2 percent . . . See Page 28.

Rocky Mountain activity increases. Well completions totaled 3,347 through September, up 7.24 percent over same '60 period. Nebraska's pace was 120 wells ahead of year ago total; northern New Mexico was up 107 wells; and Montana was ahead 74 wells.

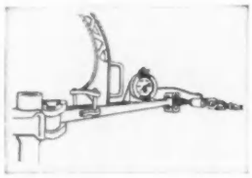
TONG TORQUE

THE MARTIN-DECKER
TONG TORQUE ASSEMBLY
FOR ALL CONNECTIONS





PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

CARE AND MAINTENANCE can be capably done by the drilling crews.

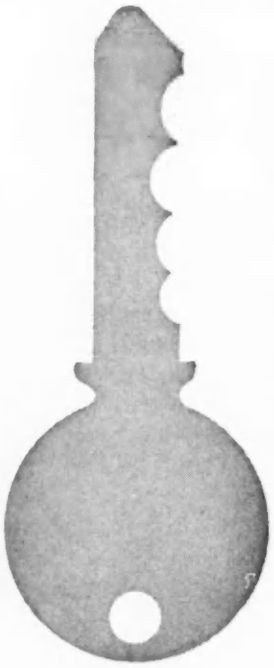
MARTIN DECKER

WRITE FOR DESCRIPTIVE LITERATURE
MARTIN-DECKER CORPORATION, DEPT. P-6A
3431 CHERRY AVENUE, LONG BEACH 7, CALIF.

World's principal manufacturer of Oil Well Drilling Instrumentation

NBT . . . YOUR KEY TO MODERN OIL FINANCING

OIL LOANS



NATIONAL BANK OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA
THE OIL BANK OF AMERICA

OFFERING COMPLETE BANKING AND TRUST SERVICES

World Oil

RAY L. DUDLEY, Founder, 1891-1957

WILLIAM G. DUDLEY.....Publisher
DONALD E. KLIEWER.....Editorial Director
L. J. LOGAN.....Associate Editor
DON E. LAMBERT.....Associate Editor, Current Outlook
WALLACE FITZGERALD.....Managing Editor
ROBERT W. SCOTT.....Engineering Editor
JACK F. EARL.....Engineering Editor
HARRISON T. BRUNDAGE.....Exploration Editor
GILBERT M. WILSON.....Western District Editor
ANTHONY GIBBON.....Mid-Continent District Editor
JACK COCKERHAM.....Presentation Editor
FERN C. REED.....Editorial Assistant
GARY DUNHAM.....Editorial Assistant
CAROL HOOPINGARNER.....Editorial Assistant
BILL JONES.....Editorial Assistant
EUNICE M. OKONESKI.....Librarian

WORLD OIL
Is Published By
GULF PUBLISHING COMPANY

EXECUTIVE OFFICES: 3301 ALLEN PARKWAY, HOUSTON
Cable Address, Gulfpubco, Houston

World's Largest Specialized Publishers to the Oil Industries

WILLIAM G. DUDLEY.....President
TOM W. NELSON.....Vice Pres.-Gen. Mgr.
R. M. DE SOMBRE.....Vice Pres.-Asst. Gen Mgr.
NELSON L. BIGELOW.....Vice President Sales
MRS. RAY L. DUDLEY.....Vice President
P. J. AUCOIN.....Treasurer

ADVERTISING

HOUSTON (1)—P. O. Box 2608
C. A. Davis, Cecil W. Smith
Phone JAckson 9-4301

SUMMIT, NEW JERSEY—382 SPRINGFIELD AVE.
Sam Sorrell, Bill DeJernett, Phone CRestview 7-1221

CLEVELAND (16)—20800 CENTER RIDGE ROAD
Bill Westfall, Phone EDison 3-1650

CHICAGO (46)—6039 N. CICERO AVENUE
Al Seymour, Phone AVenue 2-4333

LOS ANGELES—1810 FAIR OAKS AVE., SOUTH PASADENA
Jim Merrill, Phone MUrray 2-3518

TULSA (3)—916 ENTERPRISE BUILDING
Gene Hart, Phone LUther 2-9211

DALLAS (1)—2330 FIDELITY UNION TOWER BUILDING
1507 Pacific Ave.,
N. E. (Nick) Stevens, Phone RIverside 7-7344

LONDON, ENGLAND—120 MOORGATE, E. C. 2
Frank Chambers, Derek Winder, Phone MOnarch 5561

KOLN-BRAUNSFELD, GERMANY—AACHENER STRASSE 378,
Gerd Hinske, Phone 52 22 60

Advertising rates on application.

SUBSCRIPTIONS

R. B. Reilly, Circulation Manager, P. O. Box 2608, Houston 1, Texas, U.S.A. Single copies 50 cents (except special issues). Double prices for single copies more than a year old. Subscription rates: both foreign and domestic $2 a year.

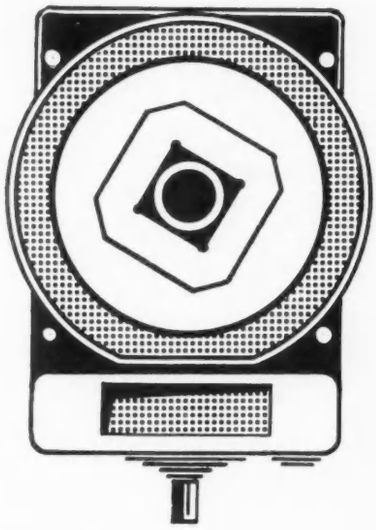
Copyright 1961 by Gulf Publishing Company. WORLD OIL and THE OIL WEEKLY are registered trademarks of Gulf Publishing Company, Houston, Texas.

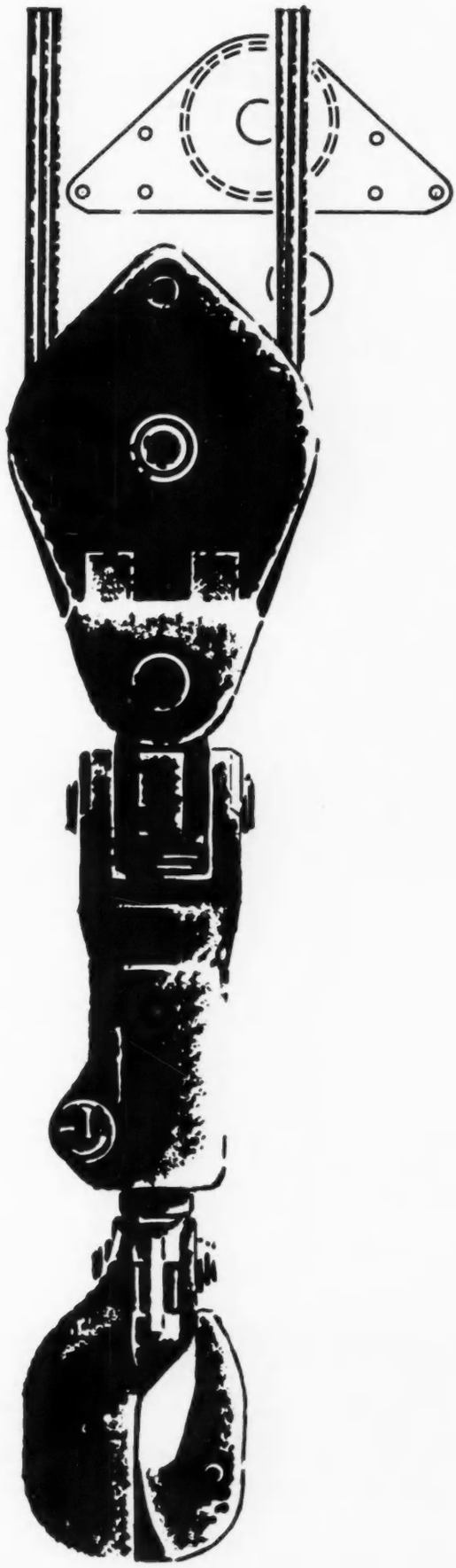
Postmaster: Send notification (Form 3579) regarding undeliverable magazines to WORLD OIL, Box 2608, Houston 1, Texas.

GPC PUBLICATIONS

WORLD OIL (formerly The Oil Weekly) and The COMPOSITE CATALOG for the drilling-producing industry.
PIPE LINE INDUSTRY and The PIPE LINE CATALOG for the oil and gas pipe line industry.
HYDROCARBON PROCESSING & PETROLEUM REFINER and the REFINERY CATALOG for the hydrocarbon processing industry.

Indexed by Industrial Arts Index and Engineering Index





DEMAG

ROTARY OIL WELL DRILLING EQUIPMENT

For more than 25 years we have developed and built rotary deep-well drilling rigs. Our rigs feature economic, quiet and reliable operation and are built on the unit construction principle. They are suitable for a variety of geological con ditions. Since almost all components used in the plant have been dimensioned according to API standards they also fit plants using conventional chain drives. Crown blocks, travelling blocks, rotary tables, gear type winches for installations from 6000 to 18000 ft.

Reprs. in USA: AMERICAN DEMAG CORPORATION
375 Park Avenue, New York 22, N. Y./One Gateway Center,
Pittsburgh 22, Pa.

DEMAG AKTIENGESELLSCHAFT DUISBURG GERMANY

another
TRETOLITE SERVICE
report

NEW PARID DISPERSANT CONTROLS PLUGGING DEPOSITS

To help you overcome the problems in petroleum production, transportation, and storage caused by residual hydrocarbon deposits, Tretolite research has produced a new chemical formulation with a remarkable record of success in field tests—PARID* Dispersant.

PARID is *not* a solvent. It functions, not as a solvent, but with a wetting and detergent action dependent on the presence of free water in the system treated. It is an organic compound, soluble in hydrocarbons and dispersible in fresh water or brine. It contains no carbon bisulfide, chlorinated compounds, arsenic, acetone, or other materials which can damage refinery catalysts. It is not hazardous to handle, use, or store. It will not corrode production equipment.

Available in either liquid or solid stick form, PARID effectively removes or prevents plugging deposits (of asphaltenes, bitumens, paraffins, and other substances normally insoluble in crude oil) which accumulate on rods, and in well tubing, flowlines, pipelines, and tanks.

For detailed information on application methods and specific money-saving results, ask the Man in the Red Car, or write . . .

*Trademark of Petrolite Corporation

PETROLITE CORPORATION

TRETOLITE COMPANY
DIVISIONS
369 Marshall Avenue, Saint Louis 19, Missouri
200 South Puente Street, Brea, California

SUBSIDIARY AND AFFILIATED COMPANIES

CANADA, Edmonton, Alberta • **ENGLAND**, London
GERMANY, Frankfurt, a. M. • **VENEZUELA**, Caracas

REPRESENTATIVES

ARGENTINA, Buenos Aires • **BRAZIL**, Rio de Janeiro • **COLOMBIA**, Bogota
ITALY, Rome • **JAPAN**, Tokyo • **KUWAIT**, Kuwait • **MEXICO**, Mexico, D. F.
NETHERLANDS, The Hague • **TRINIDAD**, Port of Spain

PD-61-1

Rig personnel, pay overhauling a 'must'

THE DRILLING CONTRACTING INDUSTRY is a very frustrating industry. And with reason. Because of the cost-price squeeze, many drilling contractors are watching not only their equipment grow more obsolete but also the quality of their rig crews decline.

Never an industry noted for unanimity, the business of selling footage for an adequate profit—fundamental as it is to the welfare of oil and gas—is beset by disagreement over the best answer to the growing scarcity of good rig crews. Many drilling contractors are bemoaning this critical development; some are trying to do something about it.

Recent unofficial contractor meetings in Denver, Lafayette, La., Oklahoma City, and Midland, Texas, acknowledged the importance of wages and hours, as well as other aspects of operating efficiency. But no general agreement resulted from these area meetings. And until the drilling contracting industry develops the leadership that is needed, it is unlikely that any industry program to solve the growing personnel problem will be forthcoming.

Despite these meetings and all that has been written about common problems, common needs and common action, the pay structures and working schedules generally found in the drilling contracting industry are uncommon.

A large number of drilling contractors' pay rates are based on the 1957 level of about $2.50 an hour. Some are paying the 1959 rate (an increase of about 10 percent from 1957). Others have instituted a 10 percent increase from the 1959 rate, but on a seven-day work week schedule. Of late, a few contractors have gone to a six-day work week, with no pay reduction from 1959 rates.

The latter group, tiny though it is, may be supplying the leadership which the industry needs. It has something to offer its rig personnel, who earn about $3.50 an hour and enjoy one day off each week.

Under this program, the group is trying to compete with other industries which have been siphoning off drilling contractor personnel by offering more money for fewer hours work. These drilling contractors are doing their best to get what all contractors want: good men to run a half million dollar rig on a hole worth probably just as much.

Some opponents of the 48-hour work week say manpower is insufficient for a six-day week. But why? To repeat, isn't it just possible that good men are being lured by other industries which have something better to offer?

Several opponents simply doubt the contractors' ability to absorb the additional labor cost. Contractors who have gone to the 48-hour week freely admit the move will cost more than increased efficiency through more qualified men will save. But they also feel that costly doubling over will decrease because each man will have one day off each week.

But even more important is the reaction of operators to the more realistic 48-hour week. Already, some indications point to the possibility that many drilling contractors' customers will request that contractors submit their pay rates and their work schedules in bidding for jobs!

And will the operators, most of whom operate on a five or six-day week, favor drilling contractors who have gone to the six-day week? Some contractors think so.

Thus, operators—in recognition of drilling contractors' efforts to improve the industry—could emerge as a powerful factor in influencing the pay and work schedules of the drilling industry.

A technical bulwark

CURRENT OBSERVANCE of the 125th anniversary of the U.S. patent system assumes even greater significance with the realization that it is one of the few constitutionally founded institutions of free enterprise which has resisted substantial curtailment over the years.

Though the patent system could stand strengthening, it has contributed markedly to technological progress in the United States and to this nation's emergence as the most highly-developed industrial power in the world.

Technical progress also can be correlated with some form of inventor incentive system outside the United States. Pre-Hitler Germany and postwar Germany are two examples of high levels of technology which can be related to strong patent systems in existence during these periods. Even Russia has recognized that men can be forced into manual labor but not into creative thinking without some incentive.

The recent technological development in Russia can be attributed to an invention incentive system. As opposed to a patent system based on law, Russia's totalitarian system is based on preferential doles and hero medals. And the whole thing exists at the whim of the governing body, and can be eliminated after serving the purpose of the state.

However, in the United States, constitutionally-protected and congressionally-provided technical progress through free enterprise is assured by a patent system which continues to benefit the public by:

- Inducing an inventor to invent, by offering some legal patent protection.
- Enabling the public to use a successfully-developed and marketed invention.
- Disseminating knowledge of an invention to anyone who wants to pay 25 cents for a copy of a patent.

Despite any real or fancied shortcomings in the U.S. patent system, it is gratifying that this area of government has not been subjected to periodic overhauling by those to whom progress means only change.

Donald E. Kliewer
EDITORIAL DIRECTOR

Good Wells Make Good News

Some Recent Frac Treatments That Gave Exceptional Results

December, 1961

Here are four recent examples of how Dowell engineers combined special materials and techniques with creative engineering to help operators get better than expected results:

- **Westmoreland County, Pennsylvania** (New Gas Well) Pay zones are the shallow Bradford and Tiona sands. Operator wanted to open more drainage area in this well than previous fracture treatments had opened in other wells in this area. He also wanted a decline rate slower than those of neighboring wells. Dowell designed a treatment using Waterfrac and high injection rates. First, the Bradford was fractured using 600 barrels gelled water and 28,000 pounds sand. Injection rate was 40 bpm at 2600 psi. Then, a wire line bridge plug was set and the Tiona was perforated and fractured. 700 barrels gelled water and 30,000 pounds sand were injected at 30 bpm and 2600 psi. *Before treatment, well produced 15,000 cfpd. 90 days after treatment, well was delivering 240,000 cfpd.*

- **Okfuskee County, Oklahoma** (New Oil Well) Pay is the lower Sonora sand at about 1230 feet. Other wells in the pool had been completed through conventional perforations and fractured with straight lease crude and 20-40 mesh sand. Production from these wells usually declined to about five bopd within two weeks. Frac sand also returned, causing pump repairs and cleanouts that often cost as much as $1000 per well. Dowell used Abrasijet® abrasive jetting service to cut notch at 1231 feet, then fractured using 5000 gallons lease crude with fluid loss control agent and 8000 pounds 10-20 mesh sand. *Well leveled off at 25 bopd and no sand troubles were encountered.*

- **Uintah County, Utah** (New Gas Well) This well is completed into a five-foot section of the Brushy Basin sand. Arasijet was used to cut two vertical notches in the casing between 7399 and 7402 feet. Dowell then fractured using water with a demulsifying agent added. First, 1000 gallons carried 250 pounds of sand and 10 gallons Freflo® to clean notches. Then 2000 gallons water without sand was injected as a spacer between sand and aluminum pellets to follow. The next 10,000 gallons carried 1470 pounds of aluminum pellets. Pellet concentration was increased during treatment from 0.02 to 0.20 pounds per gallon. Pressures during job ranged from 3600 to 4000 psi and injection rates varied from 31.0 to 11.5 bpm. Well made 1500 mcfd after treatment. *Other treatments in area using 20-40 sand as fracture prop had screened out.*

- **Midland County, West Texas** (Old Oil Well) This is a recompletion into the upper Devonian after the lower Devonian had been depleted. Production is from four sets of perforations between 11,504 and 11,646 feet. Dowell spearheaded Waterfrac with 3000 gallons BDA® breakdown acid. 60,000 gallons gelled water and 116,000 pounds sand were injected in two equal stages. 3000 gallons regular acid was injected between stages and 4000 gallons Retarded Acid injected after last stage. *After treatment, well flowed 946 bopd through a 3/8" choke. Well-head pressure was 1750 psi and gor was 2807.*

Ask your Dowell representative for suggestions about how to get better production from your wells. Dowell services and products are offered in North and South America, Europe, North Africa and Iran. Dowell, Tulsa 14, Oklahoma.

SERVICES FOR THE OIL & GAS INDUSTRY DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Looking Ahead

Drilling rig on the moon? . . . Oil industry will be major contributor to U.S. moon probe, hopefully expected in 1963. An oil company has developed miniature drilling rig only five feet high that weighs 60 pounds here, will weigh 10 pounds on the moon. Powered by cylinders of gas, the rig will drill moon crust samples that will be analyzed automatically aboard unmanned space vehicle, under control of instrumentation on earth.

Less red tape on shipping magnetic tape . . . U.S.-made magnetic tape containing seismic data is now being brought back into the country duty-free, pursuant to a recent ruling by the Commissioner of Customs. Tapes on which outside-U.S. seismic records had been recorded were previously subject to import duties as high as $17.00, compared with an original $1.00 value.

Vela Uniform blast planned . . . Atomic Energy Commission and Coast and Geodetic Survey announce Project Gnome, a 5-kiloton detonation scheduled for 8 a.m. Mountain Standard Time December 10, 1961 at Carlsbad, New Mexico. Charge is to be buried 1,184 feet below the surface at 2,212.6 feet above mean sea level. Location is east of center of Section 34, Township 23 south, Range 30 east.

Copies of usable records should be sent to Dr. Myrl F. Smith, operations coordinator Project Gnome, Carlsbad, N. M. Vela research program to try to develop feasible means to detect underground nuclear tests is expected to yield new technology useful in oil exploration. Among unique lines of research is a program to analyze subsurface telluric currents; another to use a seismometer to operate on the ocean bottom 10,000 feet below the surface.

Stripper wells offer major oil reserve . . . Interstate Commerce Commission study reveals more than 350,000 stripper wells are producing in the U.S., with 4.2 billion barrels of primary reserves. Some 3.8 billion barrels of crude may be produced through pressure maintenance, secondary recovery or other means of restoring reservoir energy. This is more than one-fourth of all U.S. crude oil reserves.

Since Bradford, Pennsylvania field went under waterflood 30 years ago, more than 330 million barrels of oil have been recovered. Another 400 million barrels is expected from waterflood operations in Illinois' Salem field and Oklahoma's North Burbank field, just to mention a few examples.

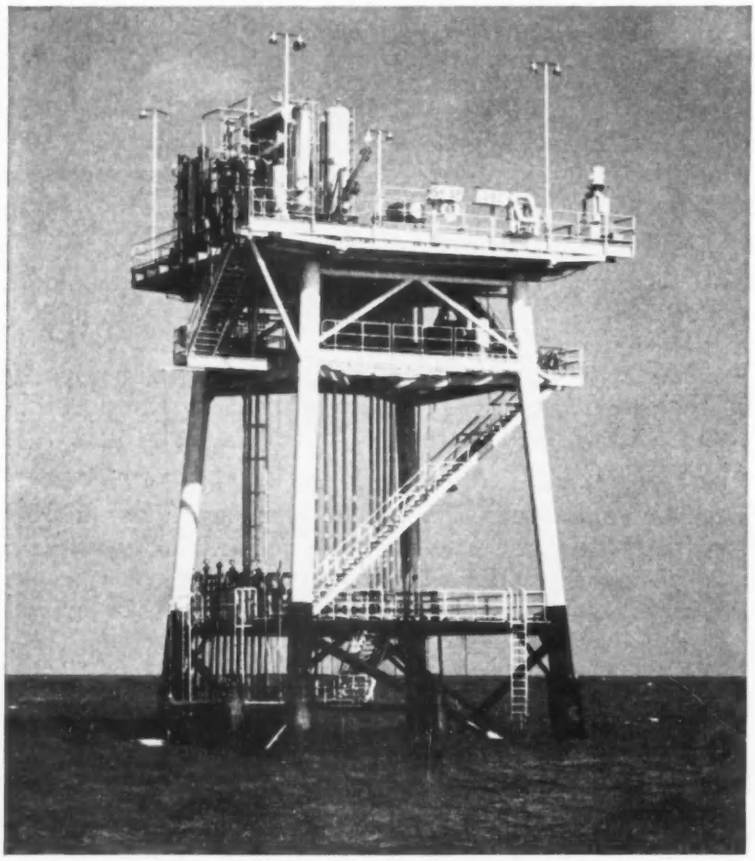
International roundup . . . Venezuela has registered strong protest over revamping of U.S. mandatory imports program, Canada is working hard at high levels to salvage as much of its current U.S. export levels as possible and U.S. State Department is trying its best to put monkey wrench in Interior Secretary Udall's plan to ease proration squeeze on domestic producers. Result: a new program starting January 1 that will satisfy no one . . . **Meanwhile, Middle East crude production jumped 8.6 percent during first nine months of this year,** despite increased intrusion of Russian oil on Free World Markets—M. E. now accounts for 25 percent of Free World production . . . **Russia, now supplying about 4.5 percent of total Free World oil needs,** is expected to up total to 7.5 percent by 1965 . . . **Last Summer, Free World demand for petroleum out paced U.S. demand for the first time in this country's history.** Outlook is for the same: While U.S. demand increases 2-3 percent over next four years, Free World demand will rise about 5 percent annually to 24 million barrels daily by 1966.

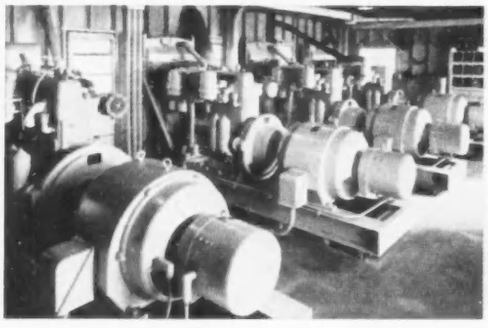
on LAND or on the SEA

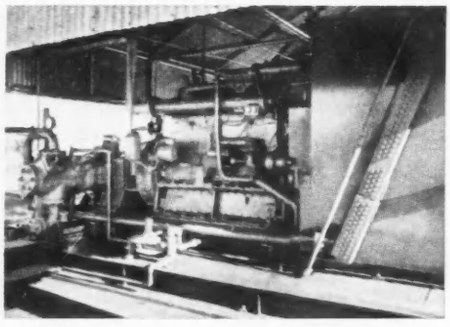
WAUKESHA

power for:

DRILLING • COMPRESSORS
WATER FLOOD • PIPE LINES
PUMPING • ELECTRIC POWER







WORLD'S FINEST OIL FIELD POWER

10 to 1235 hp

BOTH DIESELS AND "BUILT-FOR-GAS" ENGINES

520

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Huntington Park, Calif.**
Factories: Waukesha, Wis.; Clinton, Iowa; Houston, Texas

Independent oil men look at '62

By Don E. Lambert
Associate Editor, WORLD OIL

GENEROUS PORTIONS of mixed blessings, committee reports and 1962 challenges were served to members attending the 32nd annual meeting of the Independent Petroleum Association of America in Houston last month. From this heavy diet of statistics and problems came major decisions that will guide independent oil men in their actions on key issues during the coming months.

Reflecting on the meeting's many transactions, Highland Oil Company president and the 1962 leader of IPAA, Harold Decker, listed these as the key challenges that lie ahead:

Industry unity—a way must be found to stir up the independent oil man's waning enthusiasm for his industry, and to encourage him to think and act beyond his own personal interests.

Depletion provision—may be the industry's major challenge in 1962. Anti-depletion forces will intensify their attacks. All segments of the industry should unite on this key issue.

Over-refining and product price wars—seriously curtail crude oil prices, and could force some independents out of business. IPAA must find remedies, without interfering with state jurisdiction.

Natural gas regulation—high on the list of projects will be an attempt to win Kennedy administration support for new hearings on Congressman Oren Harris' H.R. 7575 or similar legislation that will free gas producers from federal control. Little hope is seen without administration support.

Russia's invasion of world oil markets—will be one of the main problems in 1962. (See September WORLD OIL, pp 71-76). The U.S. government should do all in its power to slow the Reds' cut-rate sale of oil to promote Communist domination of the world.

Imports—through efforts of IPAA and other groups a mandatory program was established that has kept millions of barrels of crude and products from U.S. shores. Further action depends upon forthcoming January 1 allocations.

Most of these pronouncements were based on decisions resulting from top level studies conducted by IPAA during the year. A resolution on natural gas, and statements on imports and Russia's oil offensive were approved by members.

NATURAL GAS RESOLUTION

IPAA reaffirmed its position that the local function of producing and gathering natural gas should be free from federal control. In brief, the resolution stated:

"There is abundant and increasing evidence that the efforts since 1954 to regulate the field sale of natural gas continue seriously to retard the industry in its responsibility to assure the consuming public expanding supplies of natural gas to meet growing needs. Conditions within the industry are deteriorating. The public interest is not being served.

". . . Although the area pricing approach represents a sincere effort of the Federal Power Commission, it is fraught with uncertainties of legality and feasibility. The need for congressional action remains.

"Now, therefore, be it resolved by the membership of the IPAA . . . that the officers of the Association hereby are directed to seek early hearings on and consideration of H.R. 7575, or other appropriate legislation to solve the problem of unworkable federal regulation of producers of natural gas; that the officers are further directed to cooperate with the Federal Power Commission in any effort to improve administratively the present intolerable situation."

How IPAA views 1962

(While Gross National Product increases 7.7 percent to $560 billion)

Category (Petroleum)	Barrels Daily	Percent Change from 1961
Domestic Demand	10,700,000	+2.8
Exports	165,000	— 0.07
Total Demand	10,235,000	+2.6
Refinery Runs	8,234,000	+0.008
New Supply Required	10,159,000	+1.0
Crude Production	7,185,000	—*
Natural Gas Liquids Production	1,020,000	+3.1

*Assuming crude oil imports remain the same as 1961. A 50,000 barrels per day reduction in imports will help some, but not significantly.

Source: IPAA Cost Study Committee

STATEMENT ON IMPORTS

Separate statements on the over-all mandatory imports program and U.S.-Canadian relationships and policies were approved by the membership.

Before outlining a 12-point imports policy the association will support in 1962, the following general statement was made:

"A healthy, vigorous petroleum industry in the United States is essential to national security.

"The industry is not healthy. It is not vigorous. Our position of energy supremacy is threatened. Our security as to oil and gas is in danger.

"During the past five years, Soviet oil production has more than doubled. U.S. production has been static. Exploration and development in Russia is expanding. There is a continuing decline in the United States.

"Earlier this year, the Interior Department conducted open hearings for a comprehensive review of the government's oil import program. This review was necessary and constructive. We commend the secretary for providing a forum at which all concerned could present their

views. The depressed conditions in the domestic industry were fully documented. The facts showed that imports were too high. The evidence was conclusive that more effective limitations on oil imports are necessary in the interest of national security.

"We are encouraged by the Secretary of Interior's announcement that we need a healthy industry and that a definite program to decrease imports is forthcoming."

Also, IPAA took a close look at Canada's announced three-year program to increase crude oil production, which includes stepped up domestic use and exports to the United States.

STATEMENT ON RUSSIA'S OIL OFFENSIVE

Following a comprehensive report on the Russian oil situation by IPAA Economic Analyst F. X. Jordan, IPAA called on the U.S. Government for help. The statement, in part:

". . . The growing intrusion of Russian oil into world-wide markets is a threat to the economies, the joint security, and the very existence of Free World nations.

"The Independent Petroleum Association of America urges the government of the United States to exert its influence, through trade policies, foreign aid and all other international programs, in the councils of free nations, to take whatever counter-actions necessary to halt and reverse this use of oil to advance the Soviet plan for world domination.

"To this end, the association instructs its officers to bring this crucial problem to the attention of all appropriate government officials."

(It is interesting to note that following WORLD OIL's analysis of the Russian oil situation, which appeared in

Distribution of Expenditures for Drilling and Completing Wells in the United States

(Based on 1959 figures)

Item	Percent of Direct Operator Costs	Percent of Total Costs
Contract footage rate payment		27.0
Contract day rate payment		12.0
Sub-total		39.0
Direct Expenditures by Operator:		
Road and site preparation	6.4	3.9
Transportation	3.4	2.1
Fuel	1.0	0.6
Water	0.5	0.3
Drilling mud	11.5	7.0
Cement and cementing service	6.6	4.0
Casing and tubing	34.1	20.8
Wellhead equipment	3.1	1.9
Well site logging	1.8	1.1
All other physical tests	1.6	1.0
Logs	4.1	2.5
Directional drilling service	0.3	0.2
Perforating	2.5	1.5
Formation treating	5.6	3.4
Tool rentals	3.3	2.0
Drill bits and reamers	2.3	1.4
Other equipment	3.4	2.1
Plugging	0.8	0.5
Supervision and overhead	4.3	2.6
All other expenditures	3.4	2.1
Sub-total	100.0	61.0
Total		100.0*

* Turnkey payments amounting to 1.2 percent of all expenditures have been excluded from this total.

Source: IPAA Cost Study Committee Survey

Cost Indexes of Items Purchased Directly by the Operator

(1959 = 100)

	1947	1948	1949	1958	1959	1960
Road and Site Preparation	64.5	69.6	72.3	97.2	100.0	102.2
Transportation	70.2	83.5	83.5	100.0	100.0	102.7
Fuel	55.0	68.1	62.4	95.0	100.0	101.7
Drilling Mud	77.3	81.2	82.7	103.9	100.0	100.0
Well Site Logging	93.8	93.8	93.8	100.0	100.0	100.0
All Other Physical Tests	77.6	88.2	88.2	100.0	100.0	100.0
Logs	56.7	59.2	59.2	96.6	100.0	103.4
Directional Drilling Service	75.0	75.0	75.0	107.1	100.0	100.0
Perforating	71.9	78.1	78.1	100.0	100.0	101.1
Formation Treating	81.0	81.0	81.0	100.0	100.0	103.2
Cement and Cementing Service	80.7	80.7	80.5	99.2	100.0	99.8
Casing and Tubing	47.4	53.2	55.4	98.1	100.0	100.0
Special Tool Rentals	82.1	82.1	82.1	100.0	100.0	100.0
Drill Bits and Reamers	70.7	74.3	79.2	105.9	100.0	100.0
Wellhead Equipment	60.0	61.5	62.3	96.1	100.0	101.8
Other Equipment and Supplies	60.2	65.3	69.0	99.9	100.0	100.1
Plugging	64.1	67.6	69.9	97.0	100.0	102.4
Supervision and Overhead	52.5	59.4	63.4	95.7	100.0	100.7
All Other Expenditures*	74.3	80.6	79.0	98.2	100.0	100.0
Composite Cost Index (1959=100)	63.2	67.8	69.2	99.1	100.0	100.7
Composite Cost Index (1947-49=100)	94.7	101.6	103.7	148.5	149.8	150.9

*Includes Water

SOURCE: IPAA Cost Study Committee Survey

the September issue, a completely different approach to solving the Reds' oil offensive was offered by several readers in letters to WORLD OIL.

(This approach was summarized in a letter from N. Thanopoulos of Athens, Greece, who said "keep government out of it." His view follows, in part:

(". . . Each of the major companies . . . has more capable marketers of the fighting type and a far better organization than the Red bureaucrats may hope they will be allowed to allocate for a commercial competition in this field. Therefore, my reply to the question 'how to check it?' is 'let the private oil companies do the checking'.")

Mixed blessings: from the 'no growth' biennium to 62,500 wells per year

Highlighting the three-day session were comments by top industry and government leaders on the current and future status of the independent oil man. The appraisals ran the gamut. Extreme optimism was expressed on the one hand. Glum pessimism on the other.

Following are some key thoughts expressed by the speakers:

Outgoing IPAA President Alvin C. Hope—". . . If we could project in technicolor and wide-wide screen the condition of this industry, as of two years ago, and as of today, the two pictures would show a great deal of similarity. Crude oil production in the United States, then, as now, would be about the same. Excessive refinery runs, marketing price wars, low allowables, declines in drilling, crude oil price erosion, would show through in both pictures. Many would have the impulse to say, 'This is where I came in.'

". . . Despite our problems with government, I believe all would agree that the economic disturbances now afflicting this industry cannot be blamed entirely on either government action or inaction. Much of the instability we are now witnessing stems from short-sighted actions within the ranks of this industry. Their correction, if they are to be corrected, can therefore be accomplished only by the industry.

"Only common sense is necessary to discern the harmful refinery and marketing practices which have been rampant in this industry. For instance, to produce a product as volatile as gasoline over and beyond any demands is certainly nonsense.

"The refiner who runs an additional 1,000 barrels per day because the only cost of doing so is the price of crude, is indulging in more nonsense. The very act when forced on the market might well cost him the entire profit of his plant. Such a practice must be condemned—yet it is being done all over the country."

"All of these, added to many other difficulties, have knocked the product price situation into a crazy quilt cocked hat. This has contributed to a very uncertain crude market which for over three years has been eroding considerably. This has also contributed greatly to capital fleeing from oil.

"Look at the majors' recent purchases of smaller producing companies. The price paid for the properties is in many instances 50 to 100 percent over the quoted prices on the stock exchanges. Thus, capital is, in itself, staying away from oil. This practice of the big buying the small is, of course, devastating to the independent—his ranks are thinning. The only comfort I get from this is that the purchasers are showing their faith in the future of the industry.

"Yet, we all know that the majors recognize the place of the independent in our industry. Yet, their actions create a paradox which is hard to explain. It is high time for this industry to put its house in order. Only management can accomplish this."

Secondary recovery and stripper wells account for:

- **Nearly one-fourth of U.S. crude reserves**
- **21.3 percent of the nation's crude production**
- **More than 65 percent of all producing wells**
- **50 percent or more of the production in 11 states**
- **Virtually 100 percent of the production in 8 states**

Source: IPAA Secondary Recovery and Stripper Well Committee

Continental Oil Company President Leonard F. McCollum—". . . The crying need today is for straight-thinking leadership and proper self-restraint at all levels in this association and others.

"This might suggest the need for some type of forum composed of leaders of all oil and natural gas trade associations. There is need for a medium through which it will be possible to communicate with each other. Independents and majors, producers and refiners, gas men and crude men, the big fellow and the little fellow—all are faced with conditions of excess.

"But, let's do a little less public shouting and a little more serious thinking. Let's give serious consideration to the ills of the industry. Let's identify them. Let's define them. And then, let's solve them.

". . . It solves nothing to pit one man against the other, or one segment against the other.

will your son be an oilman?

As he grows will the smudges on his face turn to oil from a rig encountering pressures and depths not dreamed of today? Will he progress from that rig to a panelled office somewhere high in the sky from which he directs a far flung empire of drilling and producing? Will his searches be costly or economical? Failures or completions? Much of your oilman son's success story will depend on new mud products evaluated and developed to meet the demands of new drilling environments. That's why today a portion of every dollar you spend with Milwhite is reinvested in research for tomorrow's decreased drilling costs.

MILWHITE MUD SALES COMPANY
HOUSTON, TEXAS
DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

MILWHITE

"We talk about our troubles so much I'm afraid we are giving the industry an inferiority complex. This is unfortunate, too, because this is a great industry with a magnificent past and hopeful future. Things are actually not as bad as they seem.

"If we consider our own case, we will find we are really suffering from a glut of excesses. We have excesses in production; excesses in imports; excesses in refining; excesses in marketing and an excess of pessimism.

"Still, in the mire of all these excesses, we are faced with a shortage of domestic reserves and exploratory activities. This is serious. We must not let our (reserve) insurance lapse.

". . . We are recognized champions of conservation, yet we still indulge in the ridiculous expenditure of capital in unnecessary development wells—capital that should be put into exploration to meet future needs.

"In Texas alone it has been estimated that half of the wells drilled—100,000 out of 200,000—are unnecessary wells. Some contend that this is a conservative estimate. But it amounts to an unnecessary $10 billion capital investment in drilling alone which can never be recovered, and which has contributed nothing to reserves. It is a burden on those who have invested the money and a further burden on the public. And we wonder why production costs have climbed and why we can't possibly compete with foreign oil.

"This gives me an opportunity to pay tribute to the Texas courts and the Texas Railroad Commission. This year, in the now famous Normanna case, a Texas court held that the Railroad Commission has the legal authority needed to enforce conservation intelligently by virtually ruling out a great many unnecessary wells. The Commission, in turn, lost little time in writing one of the most courageous and far-reaching orders ever promulgated in the interest of this industry, as well as the general public.

"For this action, both the courts and the commission will come in for some unjust criticism. It has already started. Therefore, it behooves all of us to stand by the Railroad Commission and make sure that any efforts to undermine this great forward step are met headon.

". . . I am confident our worries are temporary worries. Your president, Alvin Hope, pointed out several months ago that in the next 10 years we must find and develop about 45 billion barrels of petroleum to meet the needs of the American people alone. It has been reliably estimated that in the next decade we will have to find and develop 205 trillion cubic feet of new gas.

"This calls for a greatly expanded program. It anticipates an average of 625,000 new wells, or 62,500 annually for the next decade just to meet our country's needs. What this means is that without drilling any unnecessary wells we will soon have to start drilling more wells annually than we have ever drilled before."

Champlin Oil and Refining Company Executive Committee Chairman, and current President of the United States Chamber of Commerce, Richard Wagner—". . . . What this nation needs most is a broad resumption of economic growth. That is the road to full employment and opportunities for people.

"But, if we continue to siphon off more and more of business and personal earnings for social schemes we cannot afford, then economic growth will continue to slow down. The Communists cannot, by their own efforts 'bury us' in an economic sense or militarily. That will be possible only if we continue a reckless fiscal policy, leading to more and more inflation, thus causing a further decline in our competitive position in world trade, and weakening our domestic economy.

". . . Businessmen should, at every opportunity, explain to people not in business what makes our economy function in their interests. They should understand that the seed corn of economic progress is retained earnings in business and individual possession.

"This 'risk capital,' when seeded into the economic soil, produces a crop of new enterprises, new products, new services, and most importantly, new jobs. If the seed is inadequate, the crop is deficient.

". . . This is not a partisan, political matter. Business, labor and government all want economic growth. The real difficulty is that not enough of them understand the sound route toward that growth. If we are to meet the needs of a rapidly expanding population, we must all, every segment of our society, work together in rejecting unsound adventures in statism."

U.S. Senator (New Mexico) Clinton P. Anderson—". . . Where does the United States gets its fuels, supplies of energy? The pattern keeps shifting. Mostly, we get them from our own mines and wells, but some supplies come from a variety of foreign countries. Perhaps we could get along without these foreign supplies—perhaps we could obtain everything here at home. But perhaps not. And, aside from that question, there is the fact that United States strength is part of a free world strength.

"Someone has said that the collective strength of the free world is greater than the sum of its parts. I think that is true.

"If so, it is time we took a good comprehensive look at the facts of United States energy demand and supply. And that brings me back to Senate Resolution 105 and the (National Fuels Policy) study it proposes.

". . . Resolution 105 calls for three steps: (1) A study of the demand for energy in the United States, currently and in the future, and the nation's ability to meet that demand; (2) A review of existing laws and policies in regard to their effect upon demand and supply; (3) Consideration of policy modification, based upon what is revealed by the first two steps, and the need for legislation if changes are determined to be necessary."

IPAA's position on the study: the domestic oil and gas producing industry has nothing to hide and nothing to lose by a congressional study of the nation's fuels and energy resources. IPAA always has opposed end use controls, but never has opposed a study by Congress.

In summing up the meeting, these thoughts stand out far beyond the others:

The independent oil man faces many serious problems,

Security
Security
ROCK BIT
Security
Security
ROCK BIT
ROCK BIT

SECURITY *thp*

gets you lowest cost per foot

It's a documented fact: Security now makes the finest bits in the industry. Further, Security ***thp*** . . . total hole program, using Security bits all the way . . . will save you thousands of dollars per year. Actual in-the-field tests . . . as illustrated by the typical chart below . . . have proved repeatedly that Security bits beat all penetration speed records in comparison with other bits used in similar drilling conditions. Security ***thp*** will pay off for you, too!

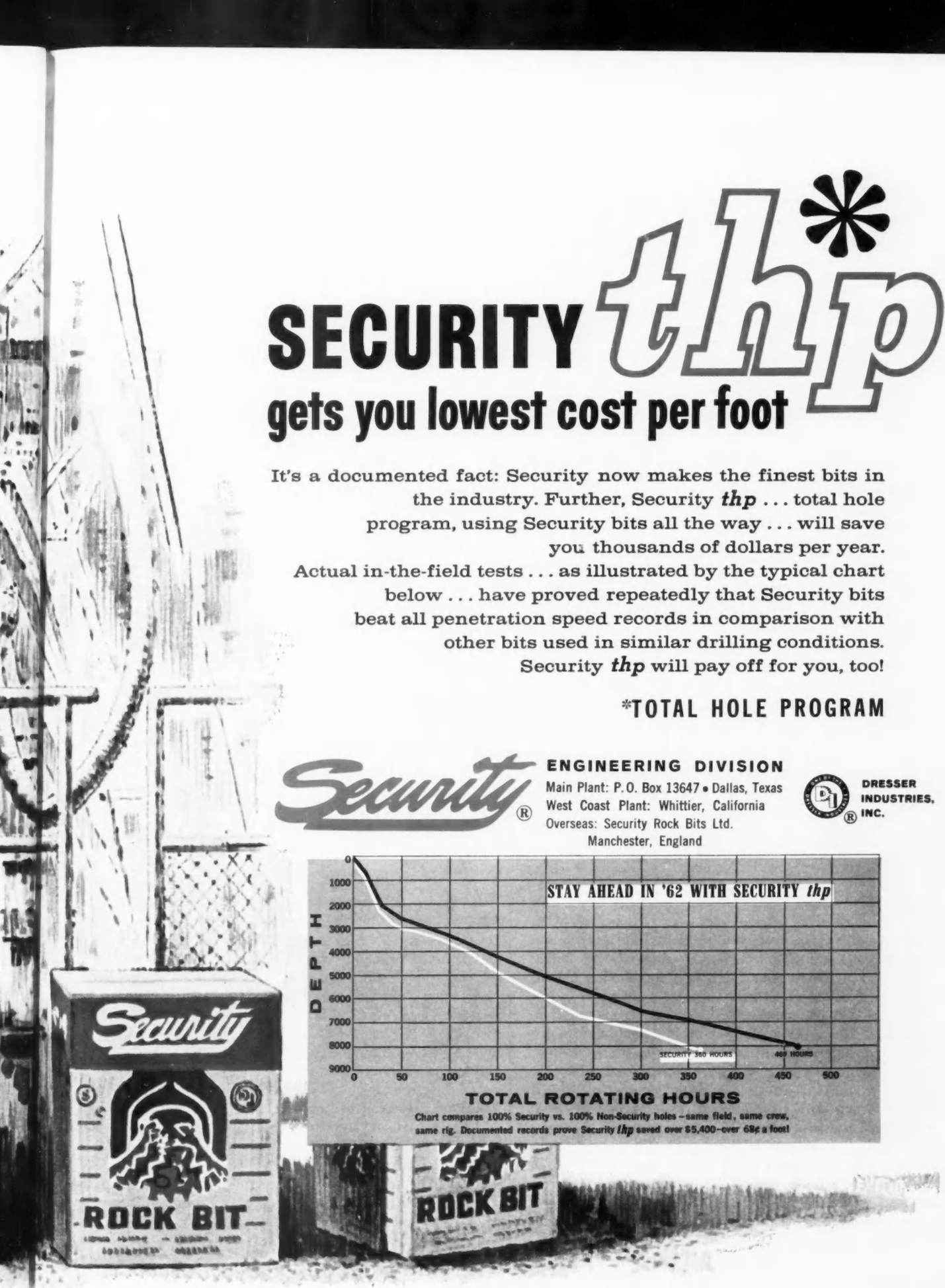
***TOTAL HOLE PROGRAM**

Security®

ENGINEERING DIVISION
Main Plant: P. O. Box 13647 • Dallas, Texas
West Coast Plant: Whittier, California
Overseas: Security Rock Bits Ltd.
Manchester, England

DRESSER INDUSTRIES, INC.

Chart compares 100% Security vs. 100% Non-Security holes – same field, same crew, same rig. Documented records prove Security *thp* saved over $5,400–over 68¢ a foot!



within and outside the industry. But, they will never be solved with a crying towel, publicly blaming someone else or running to Uncle Sam.

A high level forum representing all oil and gas interests, big and small, is sorely needed. Then, the industry could wash its "dirty linen" in private, rather than strew it about for the public and government critics to see.

At least an outward facade of industry unity should be a major challenge for 1962.

API:

Industry unity stressed at 41st annual meeting

ATTENDANCE AT the annual American Petroleum Institute meeting in Chicago last month totaled 5,964—the first time registration has slipped below 6,000 in several years. However, the Institute's information department reports that more papers were presented than ever before.

Behind-the-scenes committee activity on technical, statistical and economic problems was highly productive. But, the ideas put forth for public consumption chiefly concerned government, oil and gas prices, excessive drilling and competition.

Because the organization represents so many diversified industry interests, only four policy statements materialized—conservation of natural resources, including wildlife; depletion, both foreign and domestic; highway policy and gasoline taxation; and the embryonic National Fuels Policy. The statement on depletion:

"Percentage depletion at existing rates on all production of oil and gas provides necessary and appropriate tax treatment in the public interest which should be maintained without any reduction and without discrimination between small and large operators or between domestic and foreign production."

The main speakers' topics covered much the same ground as the annual IPAA meeting. They included:

Industry unity—There are more than 50 oil trade organizations. Undoubtedly many of these are serving useful functions, but the effect of many of their actions suggests an industry divided against itself. A critical self-examination by all of us, including each of these trade associations, might show us the way to work together as a more harmonious and effective unit. (M. J. Rathbone, President, Standard Oil Company, New Jersey).

Over-refining and product price wars—One of the major industry problems is oversupply. Oil men have

Continued on Page 22

What's happening in the oil country

Active Cretaceous chalk play is underway in **Louisiana's Sabine Parish,** where both oil and gas are being found at about 3,000 feet; independents and majors are both in on the scramble . . . Rank wildcat being drilled by Pure Oil in **Dona Ana County, New Mexico** (about 30 miles northwest of El Paso, Texas) may be very important; well is projected to 11,500 feet; rig is rated to 15,000; but the subsurface geology is so slightly known that some geologists claim basement could occur as shallow as 4,000 feet . . . Cities Service has signed a 20-year contract to participate in the waterflooding of 14,905 acres in **Argentina's Comodoro Rivadavia,** where wells have been producing since 1917 . . . One of the most important rank wildcats in the Appalachians now is underway in **Pennsylvania's Marion County,** with target depth of 15,000-16,000 feet; Phillips Petroleum, the operator, has set casing at about 8,000 feet.

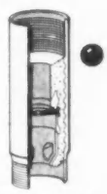
Potentially the largest undeveloped oil and gas reserve in California lies in the **offshore area of Long Beach;** a 10-month study by the city's harbor department reveals about 797 million barrels of oil and 163 billion cubic feet of gas lie untapped in town lot and offshore areas, extending five miles southeastward from Pine Avenue—will require 628 production wells and 262 water injection wells to develop . . . Mexico's Pemex will start the country's first plateau exploration program in 1962; initial activity probably will center on **high plateau areas of San Luis Potosi, Coahuila and southern Tamaulipas** —geologists predict success chances are better than 50 percent . . . Gulf Oil and Brewster-Bartle have knocked two days off the fast-drilling record they set in **Southwest Texas' Laguna Madre** area; the new record, five days and 22 hours to spud and cut hole to 8,000 feet, was made on location four miles northwest of **Port Isabel in Cameron County.**

Pan American International has acquired a 45,000 square mile concession in **Hadhramaut on Saudi Arabian peninsula;** state governments will receive 55 percent of net profits and will have option to participate in up to 20 percent of the company's rights and obligations under the agreement . . . Continental Oil is drilling an important deep wildcat in **Grand County, Utah;** the 14,700-foot venture is about 13½ miles northeast of Mississippian gas-condensate production at Salt Wash field and about 23 miles north of Paradox and Mississippian production in Big Flat field.

COLLARS

Differential Fill-Up Collar
Product No. 1091 M&F

Flexiflow Fill-Up Collar
Product No. 161 M&F



Circulating Flexiflow Fill-Up Collar
Product No. 161-D M&F

Cement Float Collar
Product No. 101 M&F

Cement Baffle Collar, with Hole
Product No. 104 M&F

Insert Valves, Float-Check Type
Product No. 176 and Flexifill Type
Product No. 177

Triplex Flapper Valve Float Collar,
Product No. 134 M&F

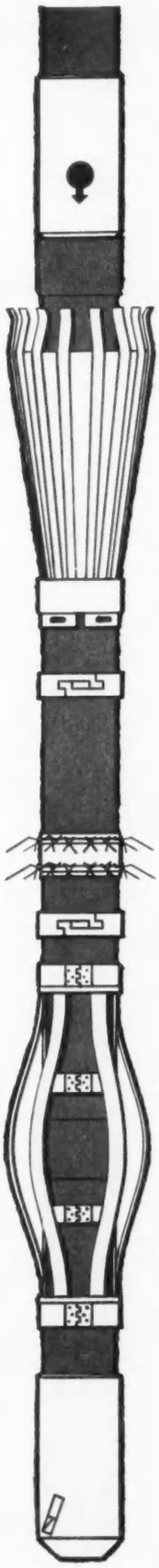
BASKETS

Metal Petal Basket, with Stop Rings
Product No. 343

Plain Hook-Up Nipple with Metal Petal Basket
Product No. 330

Avoid welding . . . lock casing shoes and collars with BAKERLOK Thread-Locking Compound Product 050

It makes good sense to buy the best primary cementing equipment *at your supply store!*



SCRATCHERS

Hinge-Lok Wall Scratcher, with 4½" long wires
Product No. 900-C

Hinge-Lok Wall Scratcher, with 2½" long wires
Product No. 900-C

Solid-Ring Wall Scratcher, with 4½" long wires
Product No. 901-C

Solid-Ring Wall Scratcher, with 2½" long wires
Product No. 901-C

Hammer-Lok Stop Rings
Product Nos. 940-B (Solid) and 945-B (Hinged)

Rotating Wall Scratcher
Product No. 903

CENTRALIZERS

"G-12" Slim Hole Casing Centralizer
Product No. 910-G

"HN-15" Solid-Ring Casing Centralizer
Product No. 908-HN

"HN-20" Solid-Ring Casing Centralizer
Product No. 908-HN

"H-15" Hinge-Lok Casing Centralizer
Product No. 9115

"H-20" Hinge-Lok Casing Centralizer
Product No. 9112

"H-25" Hinge-Lok Casing Centralizer
Product No. 9113

Hinge-Lok Rigid Casing Centralizer
Product No. 9133

SHOES

Differential Fill-Up Shoe
Product No. 1081

Flexiflow Fill-Up Shoe
Product No. 160

Cement Float Shoe
Product No. 100

Cement Wash-Down Whirler Float Shoe
Product No. 120

Cement Bull Plug Shoe
Product No. 103

Cement Guide Shoe
Product No. 102

Triplex Cementing Shoe
Product No. 1363

BAKER

BAKER

BAKER OIL TOOLS, INC. HOUSTON | LOS ANGELES | NEW YORK

For more data on advertised products, use cards, last page.

failed to accept the fact that the days of large percentage increases in demand for oil products are over. This is one problem that cannot be blamed on the White House. It is a "homing pigeon," hatched within the industry, that has come home to roost. (Frank Porter, President, American Petroleum Institute).

Natural gas regulation—Only the development of public utility regulation has made it possible for private enterprise to continue to prosper. If it were not for such regulation, the transportation industry, electric power industry and many others might well be exclusively in government hands.

The Federal Power Commission will not initiate any new area price proceedings until the first two, now underway, are functioning under tested procedures. FPC is prepared to authorize at firm prices new sales of gas in line with lower ceilings announced October 31 for southern Louisiana.

Outright exemption of small independent producers has been rejected for legal and practical reasons, but the FPC is seeking ways to ease their regulatory problems. (Joseph C. Swidler, Chairman, Federal Power Commission).

Russia's invasion of world oil markets—The United States must seek its natural allies in this economic warfare. It must convince Canada, Mexico, Venezuela, Saudi Arabia, Iran, Iraq, Kuwait, Algeria and Indonesia that they will suffer more than we will. America must compete with Russia in finding and developing oil reserves, for Russia to pay the world price for its needs and establish controls to slow the flow of western equipment and technology to Russia. (Sen. A. S. Mike Monroney, D-Okla.)

Government relations—The petroleum industry has two roles in our economy—it must contribute to our economic growth and to the welfare of our citizens and it must contribute to our national security. A depressed petroleum industry cannot make its maximum contribution in either of these two fundamental directions. A petroleum industry seeking only its own security cannot make its maximum contribution in either of these two fundamental directions.

I call upon you to examine your own position carefully, and to develop, on your own initiative, a course of action which will minimize rather than maximize the government's future role in the operations of the industry. (John M. Kelly, Assistant Secretary of the Department of the Interior).

Industry inefficiency—The petroleum industry must stop drilling so many unnecessary wells or lose the battle of falling profits. Of the 28 primary oil-producing companies listed on the New York stock exchange in 1952 or subsequently, 12 companies, or 43 percent, have been sold. Of the surviving 16, one-half have gone to foreign fields exclusively, or have diversified into non-producing activities. One way to solve this problem is to reduce the greatest waste in the industry today—excessive drilling of development wells. (Lyon F. Terry, associate of Lehman Brothers, New York investment bankers).

Viewpoints

". . . Oil must become nonpartisan. The oil industry has been the whipping boy of liberals; the Texas oil man, a political caricature—the depletion allowance a political football. We must quickly outgrow such childishness if we are to survive as a political power.

"This is not a one-sided obligation. The oil industry has also been the treasury of conservatives; the politician, an industry caricature—the government, an assumed enemy. This childishness, too, we must quickly outgrow if we are to survive."

A. S. Mike Monroney
U.S. Senator, Oklahoma

". . . I cannot sympathize with the industry in its desire to escape regulation. Such sympathy in any event would be useless in the light of the temper of the times. Moreover, as I have indicated many times before, regulation in the various fields is essential in order to curb the inevitable abuses that the system of private enterprise tends to generate. Absent such regulation, the tendency would be toward socialization and nationalization."

James M. Landis
Landis, Feldman, Reilly, and Akers, Attorneys, New York

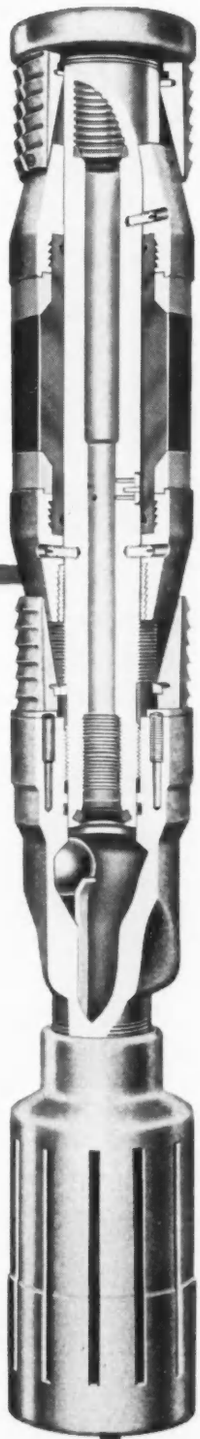
". . . No (single) operator, however well financed, can generate enough ideas that lead to adequate discovery (of oil and gas), but a large number of competing operators have demonstrated that collectively they can. As long as there is sufficient incentive for a goodly number of little fellows as well as the big fellows to try to expand their business, there is every hope that sufficient hydrocarbons will be found and developed for many years to come."

Ira H. Cram
Vice President and Chairman of the Executive Committee, Continental Oil Company

". . . If you are a reliable citizen, you will know and concern yourself about the local school board, your city offices, your county courthouse and all the officials who operate the statehouse. Further, if you are a reliable citizen, you will know the dangers of bigger and bigger government; you will recognize the telltale signs which might ultimately destroy individual freedom; and you will pass this information on to others. Above all, you will become active yourself."

Jack Cox, Vice President
Pico Drilling Company, Breckenridge, Texas

Reliable...best describes the Baker Cement Retainer



BAKER CEMENT RETAINER
PRODUCT 400

Important Facts About The Baker Cement Retainer

1. It is used for any squeeze cementing operation.
2. It is run on wire line, tubing or drill pipe.
3. Packoff is uniformly positive and dependable at either high or low pressure differentials. Opposed slips hold from either direction.
4. Ability to maintain packoff is independent of fluid pressure, or of set-down weight or tension.
5. A back-pressure valve automatically holds squeeze pressure against the formation. You can swab-test before bringing the back-pressure valve into operation.
6. The Baker Cement Retainer drills up easily and quickly. It's available in drillable, corrosion-resistant cast iron or in fast-drilling magnesium.
7. There's a full range of sizes and a family of accessories to help get the job done in the best way.
8. In some areas it is used as a bridge plug, too. It can be run as a plug—or converted to a plug simply by dropping a ball after its use as a Cement Retainer.

RELIABLE: The Baker Cement Retainer rates the word. For here is probably the most thoroughly proved squeeze cementing tool in use today. From the trend-setting original Baker Cement Retainer, to the latest refined models, it has contributed importantly to the success of tens of thousands of high-pressure squeeze operations.

It has been set successfully in thousands of shallow and medium depth wells—and at depths below 20,000 feet. It drills up quickly and easily.

THE BAKER SERVICEMAN is a man who runs Baker squeeze tools with confidence. He is a specialist—Baker tools are his only business. He knows the well-service problems of the area, because that is where he works and lives.

When there is a question about what type of squeeze tool to run, talk it over with a Baker man. He runs both the drillable Baker Cement Retainer and the retrievable Baker Full-Bore Cementer—two of the most respected squeeze packers in the industry. Call him in on your next squeeze-cementing job.

BAKER
CEMENT RETAINER

BAKER OIL TOOLS, INC. HOUSTON / LOS ANGELES / NEW YORK

Good demand for oils in October encouraging

By WORLD OIL Staff

IMPROVEMENT IN DEMAND for petroleum in October was indicated. Each of the four principal products was in substantially better demand than in October of last year. And the increases were all larger than those shown for the first three quarters of this year.

With supplies not excessive and being well absorbed by the markets, stocks of the principal refined products have remained within reasonable proportions. Inventories of gasoline are well below a year ago, and stocks of distillate fuel oil and residual fuel oil are slightly under a year ago, while kerosine stocks are up slightly.

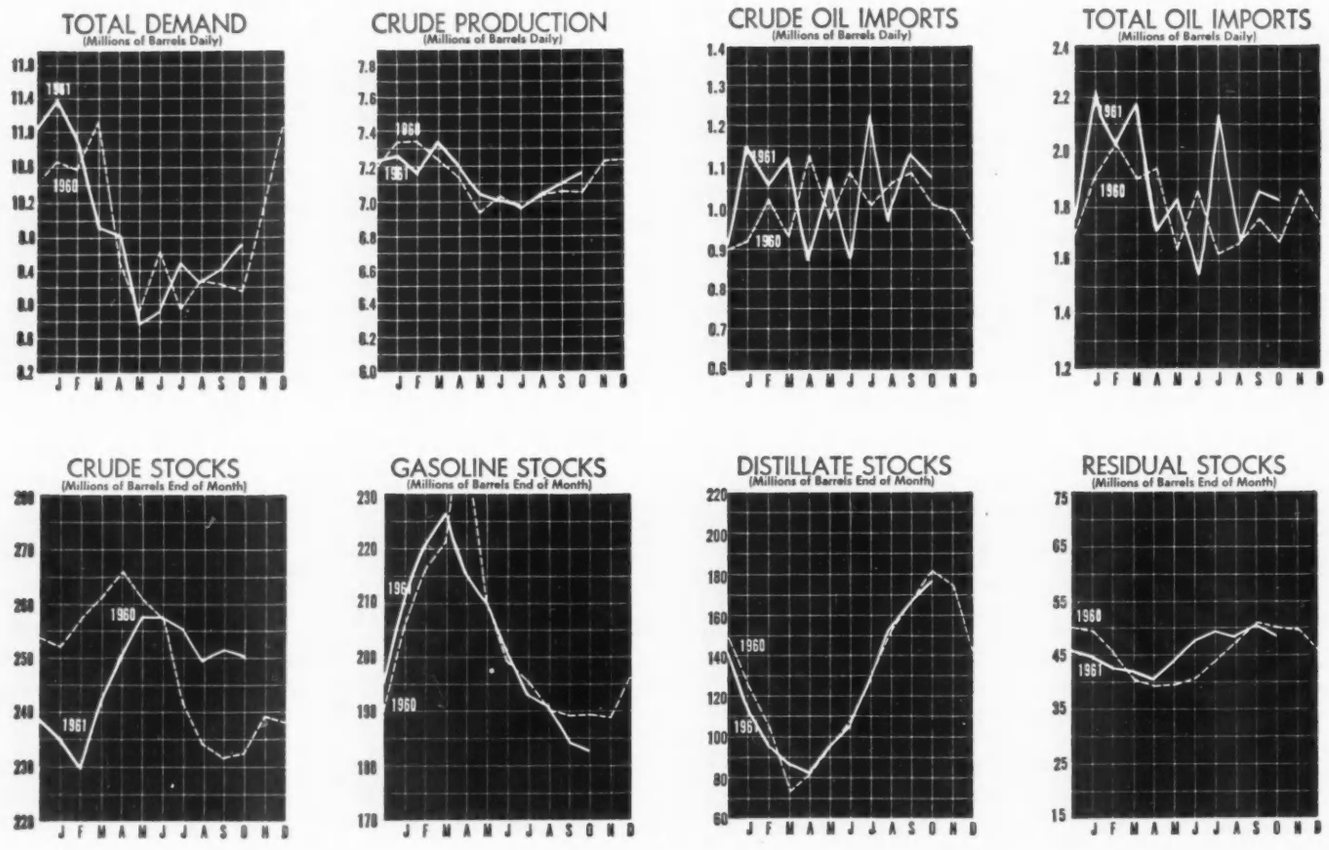
Crude oil stocks continue materially above last year, however, and there is some danger that they may prove excessive in December, under the scheduled higher crude production in Texas. That state will have 9 producing days in December, after having had only 8 per month in recent months.

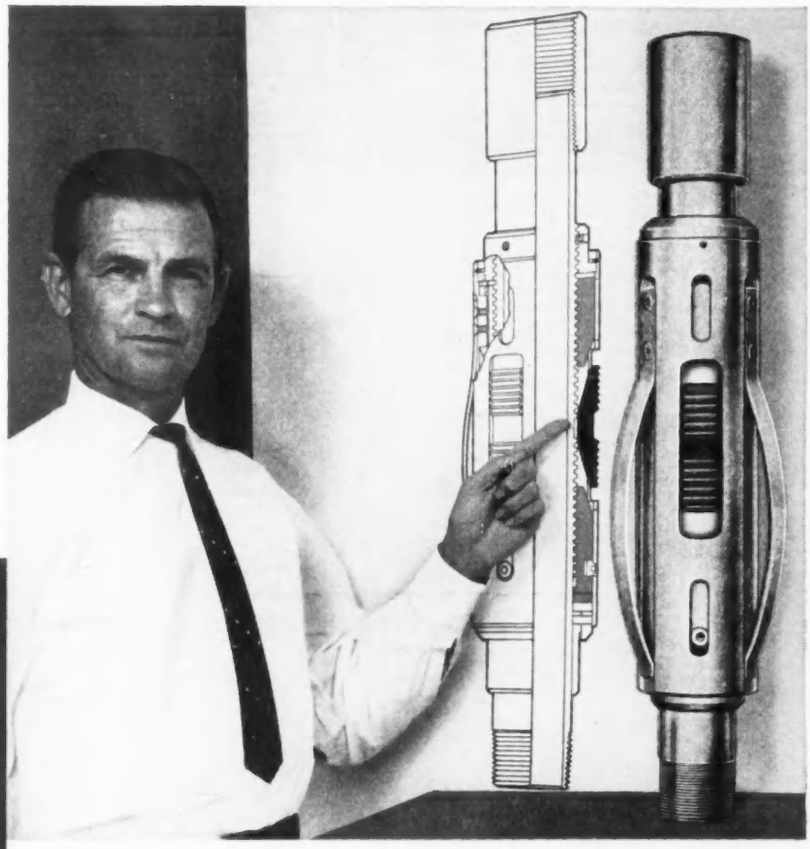
The new allowable production of 2,872,535 barrels per calendar day represents an increase of 134,231 bpd. The 9-day schedule was recommended by five major crude purchasing companies, while 8 days were favored by seven companies. That would have involved a cut of nearly 50,000 barrels in the daily allowable. Those asking an increase said it was needed to meet seasonably large demand for burning oils as colder weather arrives.

Demand in October. Encouraging for the industry were the increases in demand for oils in October. Gasoline demand was up 1.9 percent from October of last year, whereas it had been running only about 1 percent above 1960 in earlier months of this year. Distillate fuel oil demand was up 6.0 percent in October, compared with a gain of only 2.6 percent for the first 10 months of this year.

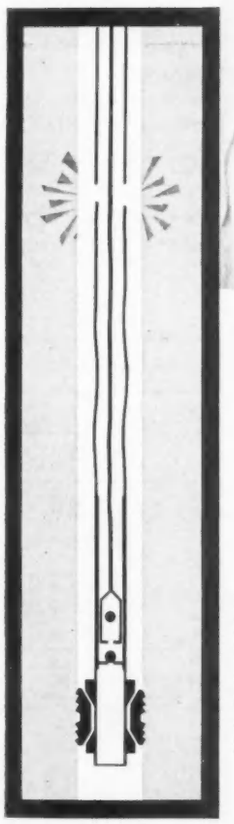
Kerosine demand showed an increase of 14.8 percent in October, which was better than the outstanding 11.4 percent gain for the first 10 months. Instrumental in causing these increases is the greater use of kerosine for fueling commercial jet planes, but other uses also apparently are contributing to the strong demand. Residual fuel oil consumption commonly reflects industrial activity, and as business thrived in October, the demand for this product was 4.3 percent above last year. This gain contrasted with a decrease of 3.3 percent in residual demand for the first 10 months of 1960,

Petroleum Trends...





"This no-movement slip-cone design makes the Baker Anchor-Catcher different . . ."



Catches Tubing Before it Falls!
No free fall should the tubing part. Possibility of a coincident rod part is greatly reduced.

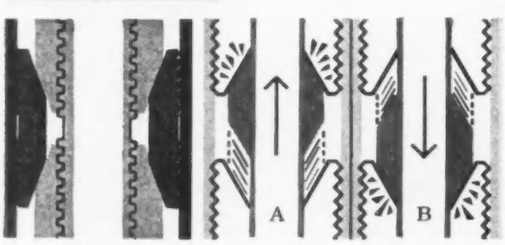
NEW BAKER TUBING ANCHOR-CATCHER COMPLETELY ELIMINATES VERTICAL MOVEMENT AT ANCHOR

Even deep wells can now be pumped more efficiently and with greater safety, because of Baker's "no movement" anchor-catcher principle.

Is no movement really important? It is . . . both in anchoring and catching tubing. This anchor-catcher stays exactly where you set it. Because it can't move downhole, it won't overstress tubing. Its positive, no-movement grip maintains the proper tension, once applied, to eliminate breathing and buckling . . . thereby reducing tubing and coupling wear and assuring maximum pumping efficiency.

The Baker Anchor-Catcher stays put—virtually catching parted tubing *before* it falls. The possibility of rod parts is greatly reduced and fishing jobs are simplified.

To learn more about the way in which this new Baker Anchor-Catcher (Product 698-B) can help you produce more oil at less cost, write for Bulletin 391. Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.



WITH A BAKER ANCHOR-CATCHER there is no movement after setting, because both cones are in full wedge-contact with the slips, which are in grip-contact with the casing.

CONVENTIONAL ANCHOR-CATCHER Insufficient tension may allow the cones to slam back and forth between the anchoring (A) and catching (B) positions during pumping cycle.

TUBING ANCHOR-CATCHER

BAKER OIL TOOLS, INC. HOUSTON | LOS ANGELES | NEW YORK

BAKER

For more data on advertised products, use cards, last page.

during which there was initially a lagging of business.

Total demand for all oils showed an increase of 1.6 percent over last year for the first 10 months, with exports further reduced and domestic consumption up 1.9 percent. With demand now improving, it seems possible that this year as a whole may show an increase of 2 percent or better.

Outlook for 1962. Demand for petroleum may be expected to show a better increase in 1962 than that which has occurred in 1961. Business in general is projected at higher levels. Consumption of all petroleum products should be stimulated. Among the developments foreseen is a big year in automobile production and a material increase in automobile registrations. This augurs well for gasoline consumption, despite continuing popularity of smaller cars among the buyers.

New supply. In view of good gains in demand in October, an increase of 3.7 percent in new supply did not appear seriously excessive. Even better justified was the domestic production 2.6 percent above last year, with crude output up 2.6 percent and production of natural gas liquids up 3 percent. Imports, however, compared unfavorably with last year, being up 8.7 percent in October—to 1,840,000 barrels daily from 1,692,000 bpd in that month last year. Imports of crude were up 7.1 percent, and receipts of refined products were up 11.2 percent.

For this year as a whole, new supply has been 3.0 percent greater than in 1960. Domestic production is up 2.8 percent, with crude oil production 2.4 percent higher and output of natural gas liquids up 5.2 percent. Total imports in the first 10 months of 1961 averaged 1,887,000 barrels daily, an increase of 76,000 barrels or 4.2 percent over 1,811,000 in 1960. Crude oil imports were up 3.7 percent, and refined products imports rose 4.8 percent.

Crude runs to stills averaged 8,187,000 barrels daily in October, up 3.5 percent from that month last year, as refiners operated in line with good demand for products. Similarly, refinery runs of 8,163,000 bpd for this year's first 10 months were up only 75,000 barrels or 0.9 percent from last year—an increase well in line with the 1.6 percent rise in demand.

U.S. Petroleum Demand and Supply (Thous. Bbls. Daily)

ITEM	October 1961	October 1960	% Diff.	Sept. 1961	January-October 1961	January-October 1960	% Diff.
DEMAND							
All Oils, Total Demand	9,755	9,131	+ 6.8	9,468	9,835	9,682	+ 1.6
Domestic Demand	9,599	8,938	+ 7.4	9,283	9,658	9,476	+ 1.9
Export Demand	185	193	— 4.1	185	180	206	—12.6
Gasoline, Total Demand	4,188	4,108	+ 1.9	4,298	4,242	4,195	+ 1.1
Distillate, Total Demand	1,564	1,476	+ 6.0	1,417	1,808	1,762	+ 2.6
Kerosine, Total Demand	388	338	+14.8	333	371	333	+11.4
Residual, Total Demand	1,418	1,359	+ 4.3	1,350	1,493	1,543	— 3.3
Other Oils, Total Demand	2,197	1,850	+18.8	2,070	1,921	1,849	+ 3.9
CHANGE IN STOCKS							
All Oils, Change in Stocks	+210	+478	.....	+483	+257	+ 74	.....
NEW SUPPLY							
Total New Supply	9,965	9,609	+ 3.7	9,951	10,051	9,756	+ 3.0
Domestic Production, Total	8,125	7,917	+ 2.6	8,090	8,164	7,944	+ 2.8
Crude Oil	7,137	6,958	+ 2.6	7,113	7,186	7,014	+ 2.4
Natural Gas Liquids	988	959	+ 3.0	977	978	930	+ 5.2
Imports, Total	1,840	1,692	+ 8.7	1,861	1,887	1,811	+ 4.2
Refined Products	753	677	+11.2	715	823	785	+ 4.8
Crude Oil, Total	1,087	1,015	+ 7.1	1,146	1,064	1,026	+ 3.7
Crude, East of California	739	750	— 1.5	797	755	753	+ 0.3
CRUDE RUNS							
Crude Runs to Stills	8,187	7,908	+ 3.5	7,951	8,163	8,088	+ 0.9
Domestic Crude	7,293	6,858	+ 6.3	6,826	7,129	7,063	+ 0.9
Foreign	894	1,050	—14.9	1,125	1,034	1,025	+ 0.9

U.S. Stocks of Oils (Million Bbls. at End of Month)

KIND OF OIL	TOTAL IN U.S. Oct. 1961	TOTAL IN U.S. Oct. 1960	TOTAL IN U.S. % Diff.	TOTAL IN U.S. Sept. 1961	EAST OF CALIFORNIA Oct. 1961	EAST OF CALIFORNIA Oct. 1960	EAST OF CALIFORNIA % Diff.	EAST OF CALIFORNIA Sept. 1960
All Oils	865.0	831.0	+ 4.1	858.5	.....	.....	.....	.....
Crude Oil	251.0	233.0	+ 7.7	252.0	222.1	201.4	+10.3	223.2
Natural Gas Liquid	44.4	36.1	+23.0	43.0	.....	.....	.....	.....
Gasoline	183.3	189.7	— 3.4	184.7	158.6	162.9	— 2.6	159.8
Distillate Fuel Oil	178.5	180.1	— 0.9	166.2	163.9	165.9	— 1.2	150.7
Kerosine	37.0	36.5	+ 1.4	35.9	34.8	35.6	— 2.2	34.1
Residual Fuel	49.1	50.0	— 1.8	50.2	32.3	34.2	— 5.6	32.9
Other Products	121.7	105.6	+15.2	126.5	.....	.....	.....	.....

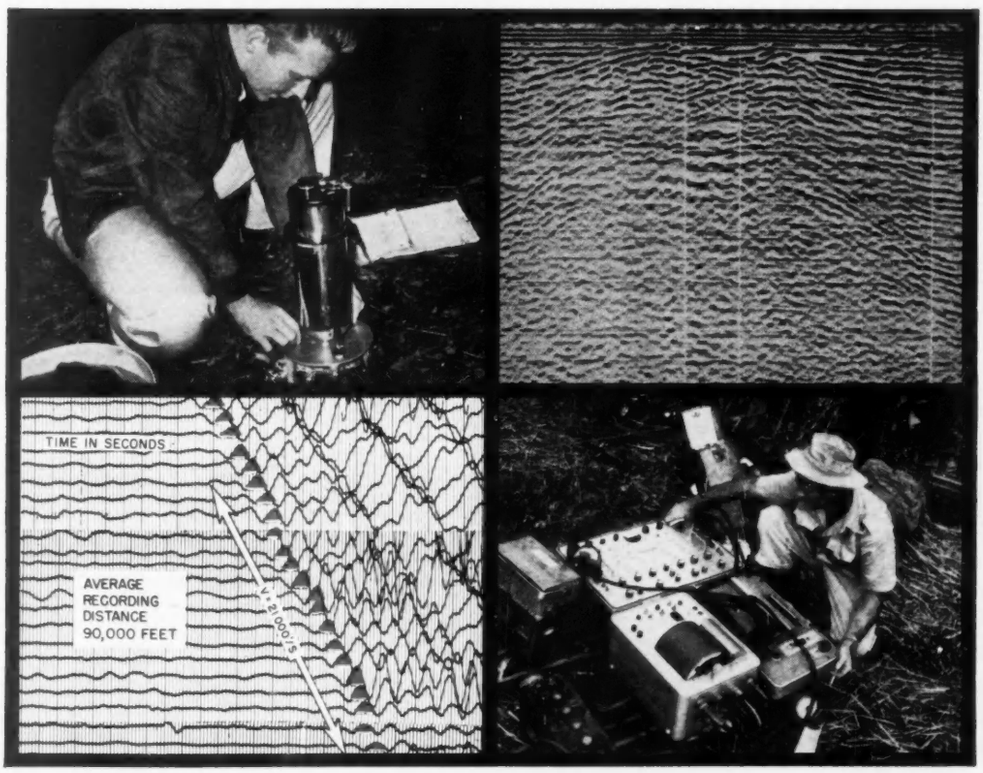
U.S. Crude Oil Production, by States (Thous. Bbls.)

STATE or DISTRICT	Daily Average for Month Oct. 1961	Oct. 1960	% Diff.	Sept. 1961	Total, January-October 1961	1960	% Diff.
Alabama	16.9	21.5	— 21.4	17.0	5,616	5,996	— 6.3
Arkansas	73.6	81.9	— 10.1	74.6	24,190	24,039	+ 0.6
California	813.7	832.9	— 2.3	811.9	249,830	253,647	— 1.5
Colorado	126.9	130.8	— 3.0	126.7	39,011	39,144	— 0.3
Florida	0.9	0.9	.....	1.0	305	311	— 1.9
Illinois	215.5	216.6	— 0.5	215.7	65,822	65,878	— 0.1
Indiana	30.8	30.7	+ 0.3	30.2	9,313	9,665	— 3.6
Kansas	308.6	310.0	— 0.5	305.6	93,902	94,218	— 0.3
Kentucky	51.2	55.4	— 7.6	51.2	15,690	18,003	— 12.8
Louisiana	1,163.6	1,101.7	+ 5.6	1,131.3	351,216	325,235	+ 8.0
North	106.8	129.2	— 17.3	109.4	37,957	38,537	— 1.5
South	1,056.8	972.5	+ 16.5	1,021.9	313,259	286,698	+ 9.3
Michigan	56.0	52.1	+ 7.5	56.0	16,265	12,475	+ 30.4
Mississippi	150.1	140.2	+ 7.1	150.1	45,267	42,883	+ 5.5
Mo.-So. Dak.-Tenn.	0.6	1.1	— 45.5	0.6	287	298	— 3.7
Montana	89.1	83.8	+ 6.3	87.8	25,677	25,182	+ 2.0
Nebraska	71.4	70.5	+ 1.3	68.2	20,535	20,358	+ 0.9
Nev.-Wash.-Alaska-Ariz.	22.8	3.2	+612.5	22.3	4,883	353	+ 1,283.3
New Mexico	316,2	293.2	+ 7.8	313.5	94,050	90,274	+ 4.2
Southeast	271.5	250.5	+ 8.4	269.9	80,508	76,484	+ 5.3
Northwest	44.7	42.7	+ 4.7	43.6	13,542	13,790	— 1.8
New York-Penna.	19.3	21.7	— 11.1	20.0	6,160	6,790	— 9.3
North Dakota	58.8	61.6	— 4.5	59.6	18,636	17,915	+ 4.0
Ohio	13.4	13.2	+ 1.5	13.2	4,214	4,175	+ 0.9
Oklahoma	508.8	516.5	— 1.5	508.5	159,402	160,248	— 0.5
Texas	2,521.1	2,430.0	+ 3.7	2,546.4	783,840	777,796	+ 0.8
Dist. 1; South Central	45.7	45.5	+ 0.4	45.4	13,989	13,481	+ 3.8
Dist. 2; Middle Gulf	112.0	104.3	+ 7.4	110.7	34,124	34,247	— 0.4
Dist. 3; Upper Gulf	348.6	332.3	+ 4.9	356.0	106,879	107,875	— 0.9
Dist. 4; Lower Gulf-S.W.	191.2	183.5	+ 4.2	192.2	58,068	57,147	+ 1.6
Dist. 5; East Central	27.1	25.3	+ 7.1	27.6	8,406	8,229	+ 2.2
Dist. 6; Northeast	250.6	231.3	+ 8.3	251.8	76,306	74,770	+ 2.1
Dist. 7-B; North Central	126.3	121.2	+ 4.2	127.7	38,446	39,221	— 2.0
Dist. 7-C; West Central	110.5	116.7	— 5.3	110.4	35,023	36,999	— 5.4
Dist. 8; West	1,004.7	958.9	+ 4.8	1,020.6	315,237	306,914	+ 2.7
Dist. 9; North	196.6	195.6	+ 0.5	196.2	58,559	59,549	— 1.7
Dist. 10; Panhandle	107.8	101.7	+ 6.0	107.8	32,209	32,861	— 2.0
Utah	92.2	82.9	+ 11.2	87.3	27,578	30,794	— 10.5
Virginia	.....	.....	.....	.....	4	5	— 20.0
West Virginia	8.1	6.6	+ 22.7	7.7	2,184	1,928	+ 13.3
Wyoming	407.3	398.6	+ 2.2	406.5	120,536	111,678	+ 7.9
Total United States	7,137.2	6,957.6	+ 2.6	7,113.0	2,184,413	2,139,288	+ 2.1

Sources for above 3 tables; Bureau of Mines monthly reports except last two months based on API and B. of M. weekly reports and WORLD OIL estimates and Texas districts from API.

GEOLOGISTS...
GEOPHYSICISTS

You are invited to write for GSI's new Facilities and Services Brochure



this 12-page brochure briefly describes GSI's facilities for:

- *Refraction Surveys*
- *Gravity-Magnetics*
- *Data Processing*
- *Offshore Surveys*
  - Single Ship
  - Seismic Underwater Explorer
  - Underwater Gravity
- *Theoretical and Applied Research*

GEOPHYSICAL SERVICE INC.
A TEXAS INSTRUMENTS COMPANY
900 EXCHANGE BANK BLDG. • DALLAS 35, TEXAS

Drilling goes ahead of 1960 in October

By WORLD OIL Staff

U.S. DRILLING climbed above last year's trend during October, after having failed to reach 1960 levels in earlier months. Both the number of wells completed and footage drilled were up in October.

The active drilling of October narrowed the gap by which field work of 1961 lags under 1960. At the end of October, new well completions for this year totaled 37,268, off 1,412 wells or 3.7 percent.

Footage drilled in this year's first 10 months totaled 156.8 millon feet, a decrease of only 3.2 million feet or 2 percent.

The 4,279 new wells completed in October compared with 4,184 in that month last year, a gain of 95 wells or 2.3 percent. The 17,748,452 feet of hole drilled in October was an increase of 939,370 feet or 5.6 percent over 16,809,082 feet recorded in that month a year ago.

Western Canada also has narrowed the margin by which drilling for 1961 fails to equal that of 1960. Again in October, as in September, Western Canadian completions and footage were above last year's trend. For this year through October, completions totaled 1,955, compared with 2,074 in the like period last year, a decrease of 5.7 percent. Footage drilled amounted to 10,871,565 feet, against 11,358,982, a decline of 4.3 percent.

U.S. Drilling Activity in October and First Ten Months, 1961

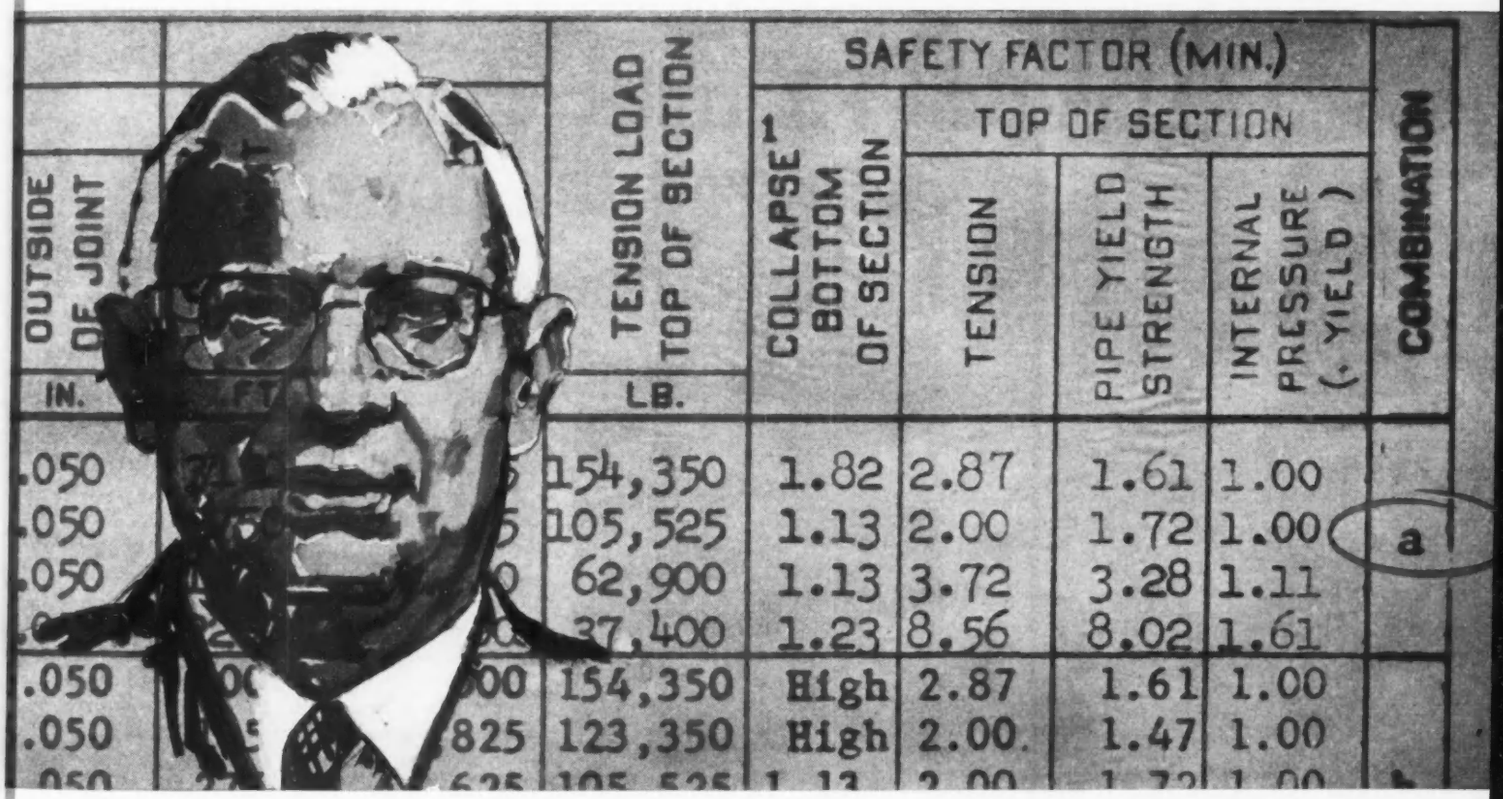
STATE or DISTRICT	TOTAL NEW WELLS COMPLETED									WILDCATS COMPLETED						†Active Rigs End of Month
	October							January-October		October					Jan-Oct. Total	
	Oil	Dist.	Gas	Dry	Service	Total Wells	Total Footage	Total Wells	Total Footage	Oil	Dist.	Gas	Dry	Total Wells		
Alabama	1	....	....	1	....	2	15,326	34	369,932	....	....	....	1	1	7	9
Alaska	1	....	1	3	....	5	40,057	42	414,898	....	....	1	3	4	16	12
Arizona	....	....	....	....	....	....	....	12	31,201	....	....	....	....	....	8	9
Arkansas	17	....	2	27	....	46	171,070	416	1,557,902	....	....	....	12	12	84	39
California	157	....	15	48	2	222	760,162	1,542	6,482,993	1	....	1	27	29	233	158
Colorado	7	....	16	41	....	64	311,905	465	2,245,065	....	....	2	25	27	230	47
Illinois	84	....	1	117	....	202	437,925	1,482	3,250,339	1	....	....	46	47	403	342
Indiana	17	....	....	44	....	61	103,490	653	999,339	....	....	....	20	20	182	85
Kansas	180	....	24	194	17	415	1,483,948	3,952	14,098,631	9	....	2	47	58	599	229
Kentucky	70	....	22	85	1	178	146,480	1,802	1,415,709	1	....	....	9	10	48	160
Louisiana	172	17	37	168	....	394	2,708,865	3,145	23,062,869	5	....	....	69	74	502	321
North	77	....	27	97	....	201	731,945	1,359	4,547,557	4	....	....	46	50	258	80
South	95	17	10	71	....	193	1,976,920	1,786	18,515,312	1	....	....	23	24	244	241
*Gulf of Mexico	15	2	1	12	....	30	323,759	430	4,463,246	....	....	....	5	5	39	55
Michigan	13	....	8	43	....	64	201,663	580	1,853,642	1	....	1	21	23	224	102
Mississippi	14	1	6	42	....	63	608,787	480	4,709,573	3	....	....	21	24	151	59
Missouri	....	....	....	....	....	....	....	13	21,167	....	....	....	....	....	....	....
Montana	16	....	....	26	....	42	221,649	361	1,912,440	1	....	....	18	19	163	29
Nebraska	25	....	1	60	....	86	406,744	834	3,819,030	2	....	....	39	41	415	27
New Mexico	72	....	37	50	....	159	878,580	1,511	7,840,862	2	....	....	24	26	211	136
Southeast	60	....	3	35	....	98	554,152	893	4,787,530	....	....	....	14	14	156	74
Northwest	12	....	34	15	....	61	324,428	618	3,053,332	2	....	....	10	12	55	62
New York	7	....	8	8	18	41	74,250	335	586,625	....	....	....	....	....	....	30
North Dakota	11	....	....	12	....	23	130,006	206	1,263,193	1	....	....	7	8	54	14
Ohio	61	....	20	23	....	104	258,318	840	2,072,996	1	....	1	3	5	40	101
Oklahoma	299	5	29	123	74	530	1,709,374	4,134	15,434,770	2	1	3	22	28	306	609
Pennsylvania	15	....	16	6	24	61	154,460	533	1,360,464	....	....	2	2	4	38	83
South Dakota	....	....	....	....	....	....	....	5	30,537	....	....	....	....	....	6	1
Tennessee	....	....	1	3	....	4	1,591	72	51,976	....	....	....	2	2	37	20
Texas	675	1	151	406	29	1,262	6,002,002	11,884	54,380,157	9	....	5	233	247	2,442	818
District—																
1: South Central	58	....	6	34	....	98	256,484	719	2,009,691	1	....	....	22	23	242	42
2: Middle Gulf	13	....	17	26	....	56	413,856	647	4,362,840	....	....	1	16	17	209	58
3: Upper Gulf	47	....	19	31	....	97	711,080	965	6,550,425	....	....	1	18	19	215	83
*Gulf of Mexico	....	....	1	....	....	1	11,722	7	74,750	....	....	....	....	....	5	....
4: Lower Gulf-S.W.	46	....	35	37	1	119	717,617	1,074	5,979,085	....	....	2	26	28	272	84
5: East Central	13	....	1	8	....	22	160,801	208	1,344,238	....	....	....	5	5	103	34
6: Northeast	54	1	2	22	....	79	422,542	792	4,105,778	1	....	1	17	19	130	38
7-B: North Central	51	....	12	68	1	132	432,984	1,458	4,487,923	3	....	....	42	45	438	56
7-C: West Central	36	....	7	17	....	60	269,961	539	2,465,369	....	....	....	11	11	176	72
8: West	196	....	7	53	9	265	1,372,681	2,367	12,710,089	4	....	....	34	38	330	167
9: North	120	....	9	85	16	230	697,411	2,167	5,851,334	....	....	....	29	29	257	108
10: Panhandle	41	....	36	25	2	104	546,585	948	4,513,385	....	....	....	13	13	70	76
Utah	3	....	4	12	....	19	110,802	182	1,084,901	1	....	2	10	13	79	54
Washington	....	....	....	1	....	1	3,009	12	49,809	....	....	....	1	1	10	....
West Virginia	37	....	71	26	....	134	330,286	946	2,350,972	....	....	....	....	....	....	201
Wyoming	33	....	13	50	....	96	472,903	767	3,922,368	....	....	2	39	41	282	60
Others	....	....	....	1	....	1	4,800	28	146,629	....	....	....	....	....	15	5
Total U.S. October, 1961	1,987	24	483	1,620	165	4,279	17,748,452	37,268	156,820,989	40	1	22	701	764	6,785	3,760
September, 1961	1,724	19	460	1,457	99	3,759	15,476,500	....	....	40	5	27	624	696	....	3,739
October, 1960	1,996	70	402	1,599	117	4,184	16,809,082	38,680	160,002,081	48	4	19	674	745	7,602	3,482
Western Canada October, 1961	133	....	36	62	....	231	1,250,097	1,955	10,871,565	....	....	....	....	....	....	170
September, 1961	131	....	38	49	4	222	1,181,493	....	....	....	....	....	....	....	....	180
October, 1960	141	....	24	55	2	222	1,247,934	2,074	11,358,982	....	....	....	....	....	....	157

* Gulf of Mexico wells are included in their respective district totals. † Includes wells rigging up, drilling, and temporarily shut-down.

The wizard of oil

This National Tube field engineer is a modern-day Merlin, because he designs more economical and more efficient casing combinations.

He does it without magic or sleight-of-hand, but with years of field experience and technical knowledge. He figures several casing combinations with razor-sharp accuracy, lists them on a form, and submits it to a customer. The customer then picks the combination that best fits his program—in this case it was combination "a."



OUTSIDE OF JOINT IN.	FT	TENSION LOAD TOP OF SECTION LB.	SAFETY FACTOR (MIN.) COLLAPSE[1] BOTTOM OF SECTION	TOP OF SECTION TENSION	TOP OF SECTION PIPE YIELD STRENGTH	TOP OF SECTION INTERNAL PRESSURE (. YIELD)	COMBINATION
.050		154,350	1.82	2.87	1.61	1.00	
.050		105,525	1.13	2.00	1.72	1.00	a
.050		62,900	1.13	3.72	3.28	1.11	
		37,400	1.23	8.56	8.02	1.61	
.050		154,350	High	2.87	1.61	1.00	
.050		123,350	High	2.00	1.47	1.00	

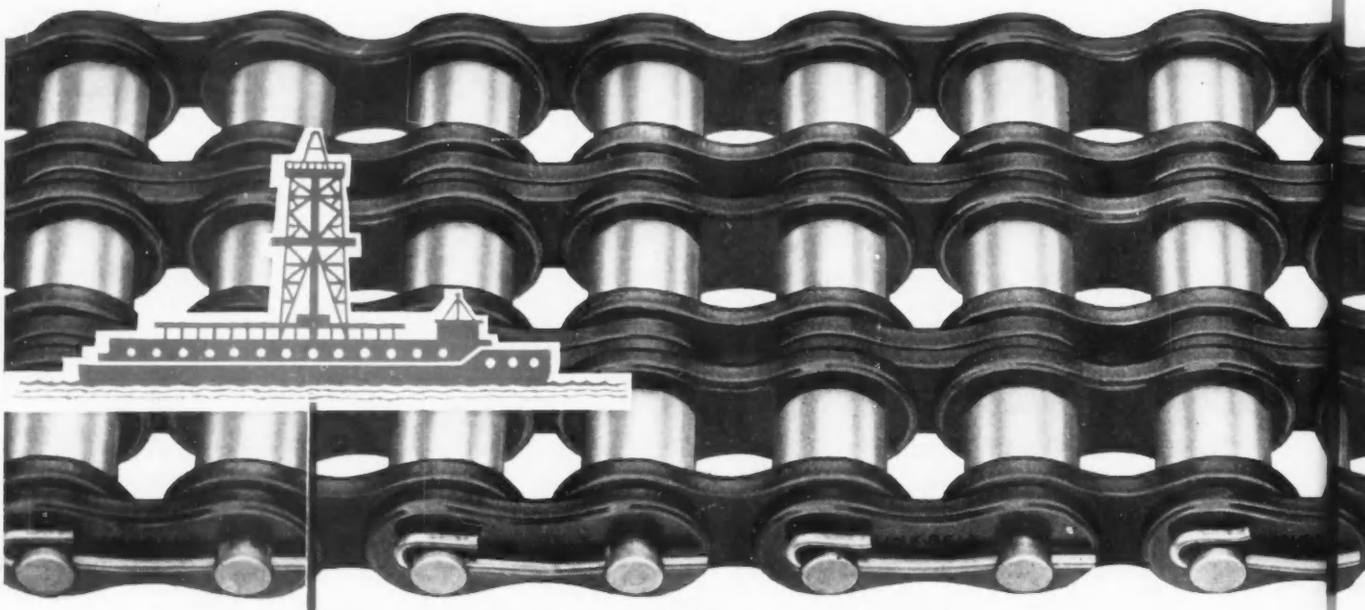
Our field expert carefully explores the customer's operating methods. Does he run his string fast or slow? Type of equipment? Drilling technique? Location? If it's an offshore project, he'll include an extra safety factor. This engineer's strict attention to detail results in a casing combination that promises efficient, economical and satisfactory service.

A great many customers have benefited from our experience. You can too. National Tube is the world's largest and most experienced manufacturer of tubular products. Write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS and National are registered trademarks

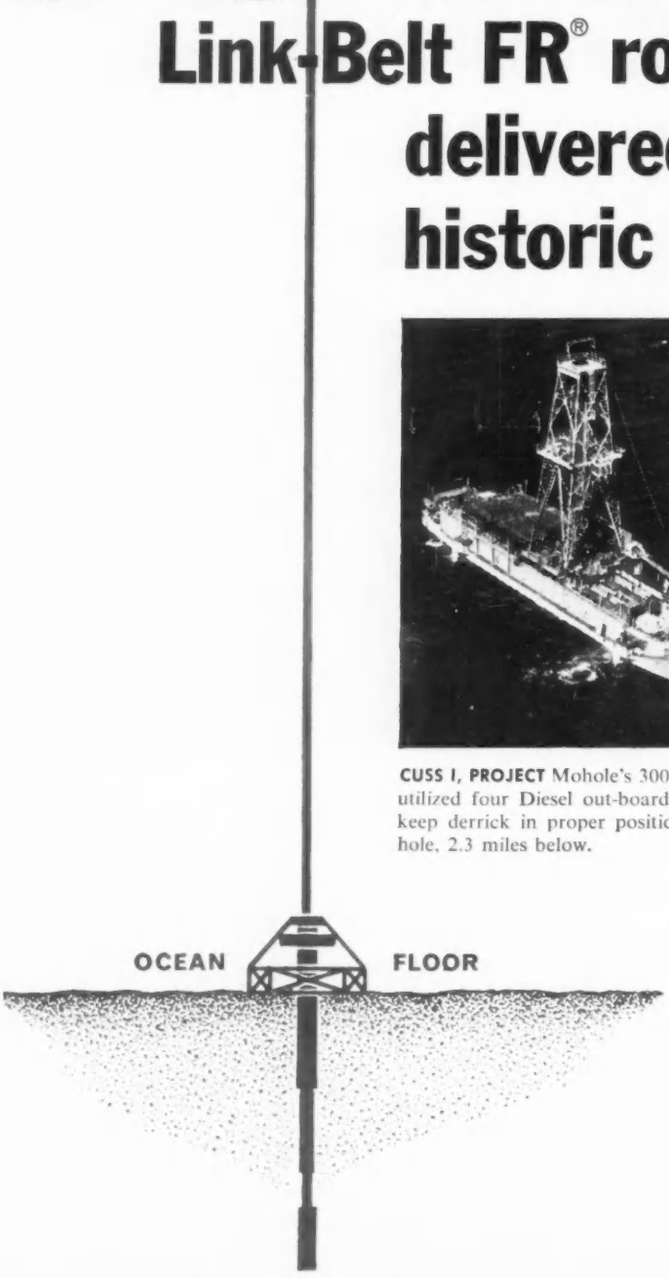
National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York



Link-Belt FR® roller chain delivered the power in historic deep-water probe

CUSS I, PROJECT Mohole's 3000 ton barge utilized four Diesel out-board engines to keep derrick in proper position over the hole, 2.3 miles below.



Several months ago, out in the Pacific, history was made. In 11,696 feet of turbulent sea, man probed closer to the earth's innards than ever before.

Link-Belt FR roller chain played a decisive role in this first phase of Project Mohole. It transmitted power to pumps and drawworks . . . helped control a quarter of a million pounds of drill string stretching down through unpredictable ocean currents.

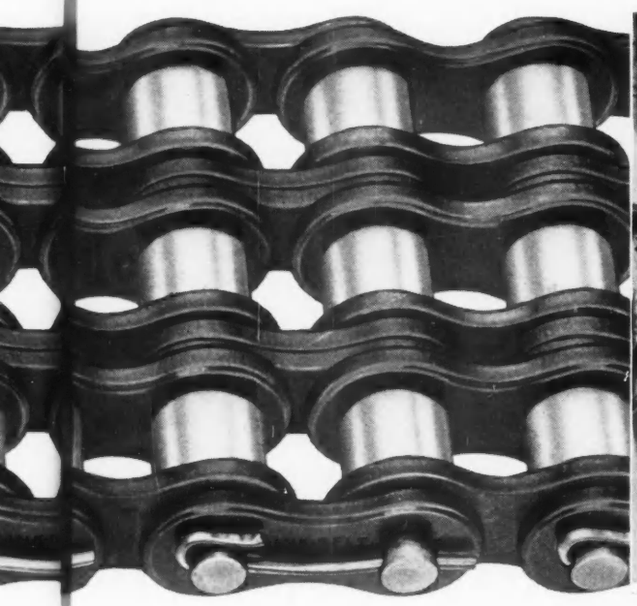
The unusual drive arrangement shown in illustration at right requires roller chain with capacity to withstand smashing impacts and tortuous stresses met in day to day drilling. The exceptional endurance required of equipment owned and operated by Global Marine Exploration Company is just another reason why Link-Belt FR roller chain has been the choice of rig manufacturers for many years.

For full data on the chain that assures *more on-bottom time*, ask any leading supply store for our Catalog 2980. And for engineering assistance in applying FR roller chain, write Link-Belt Company, Indianapolis, 6.

LINK-BELT

ROLLER CHAINS AND SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 6, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 15,743



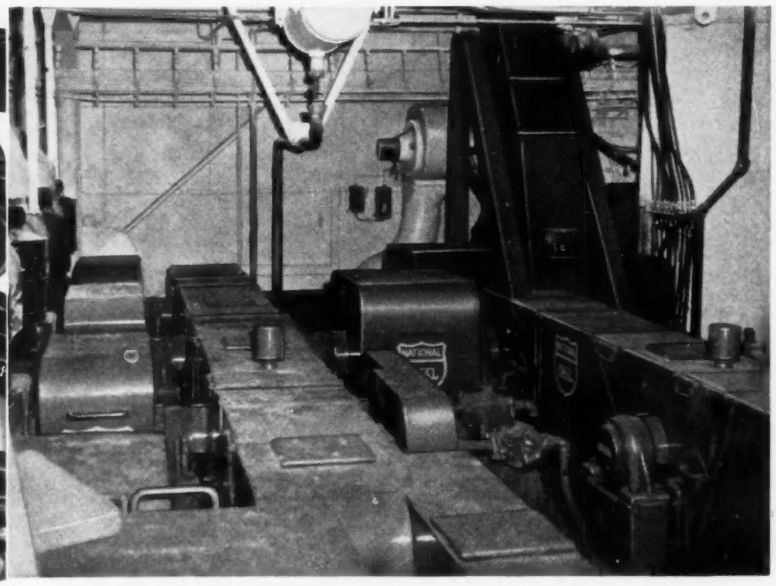
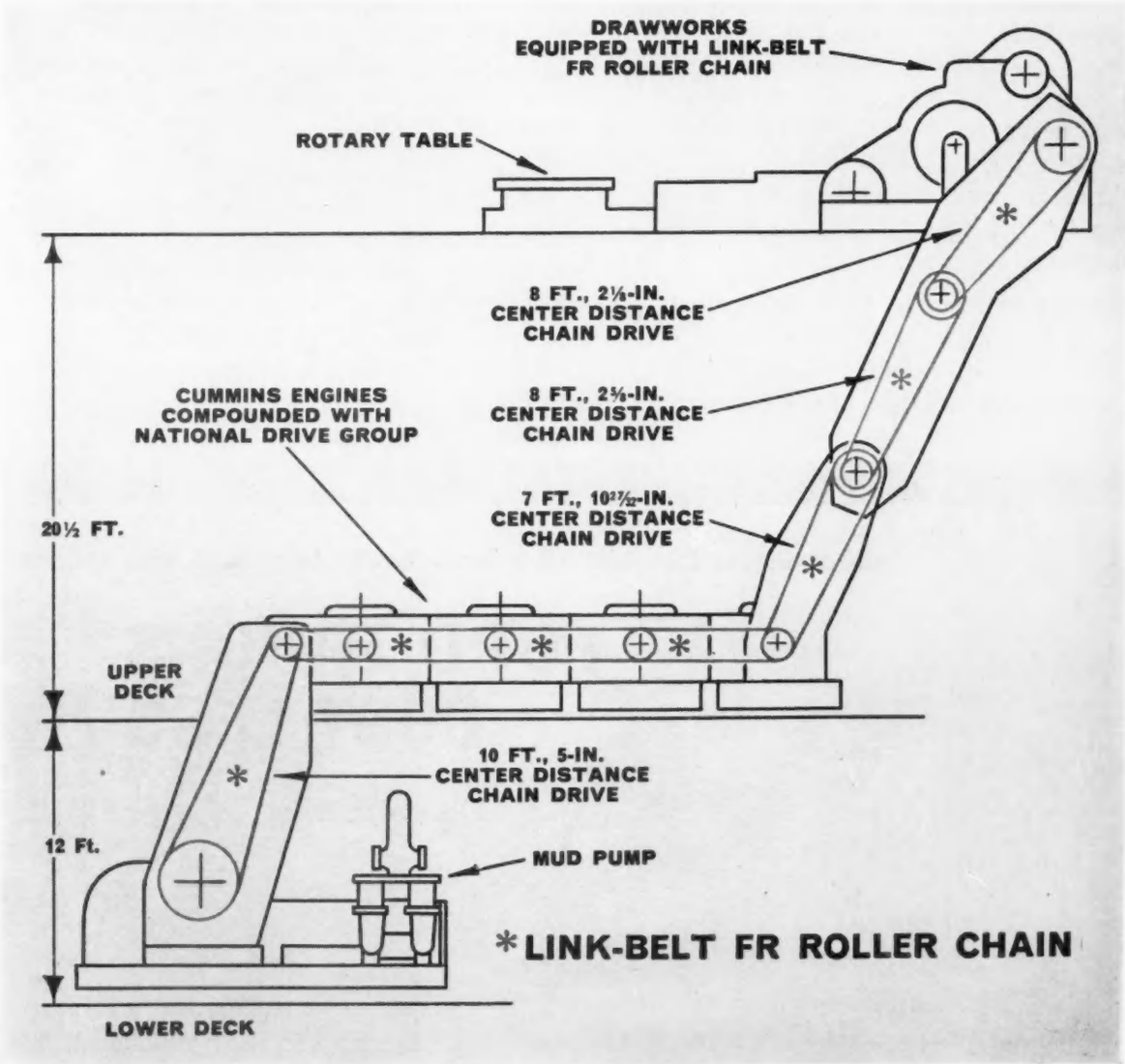


PHOTO OF NATIONAL SUPPLY DRIVE GROUP for compounding the power of Cummins engines required for operation of drawworks and mud pumps.



"Our Ford Trucks save us 2.3¢ per mile"

says Mr. R. M. Johnson, Vice President, Cosden Petroleum Corporation, Big Spring, Texas

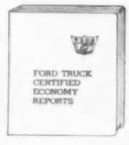
"Our latest six-month truck operating expense summary shows that Ford Trucks cost only 8.6¢ per mile to run compared to 10.9¢ for our total truck fleet. This average covers all of our production, refining, marketing, pipeline and administration trucks. Since these figures include all maintenance and repair work, durability and reliability are two big factors that contribute to lower operating expense.

"Ford Trucks lead the fleet in these respects, too. A good case in point is our 1956 Ford F-800 winch truck. Its odometer reads just over 24,000 miles *but the engine has run an average of 7 hours a day, 5 days a week for the last 6 years.* Actually there are well over 8,000 hours on the engine so far, and without a major overhaul . . . this is service that we feel is the equivalent of 300,000 hard miles.

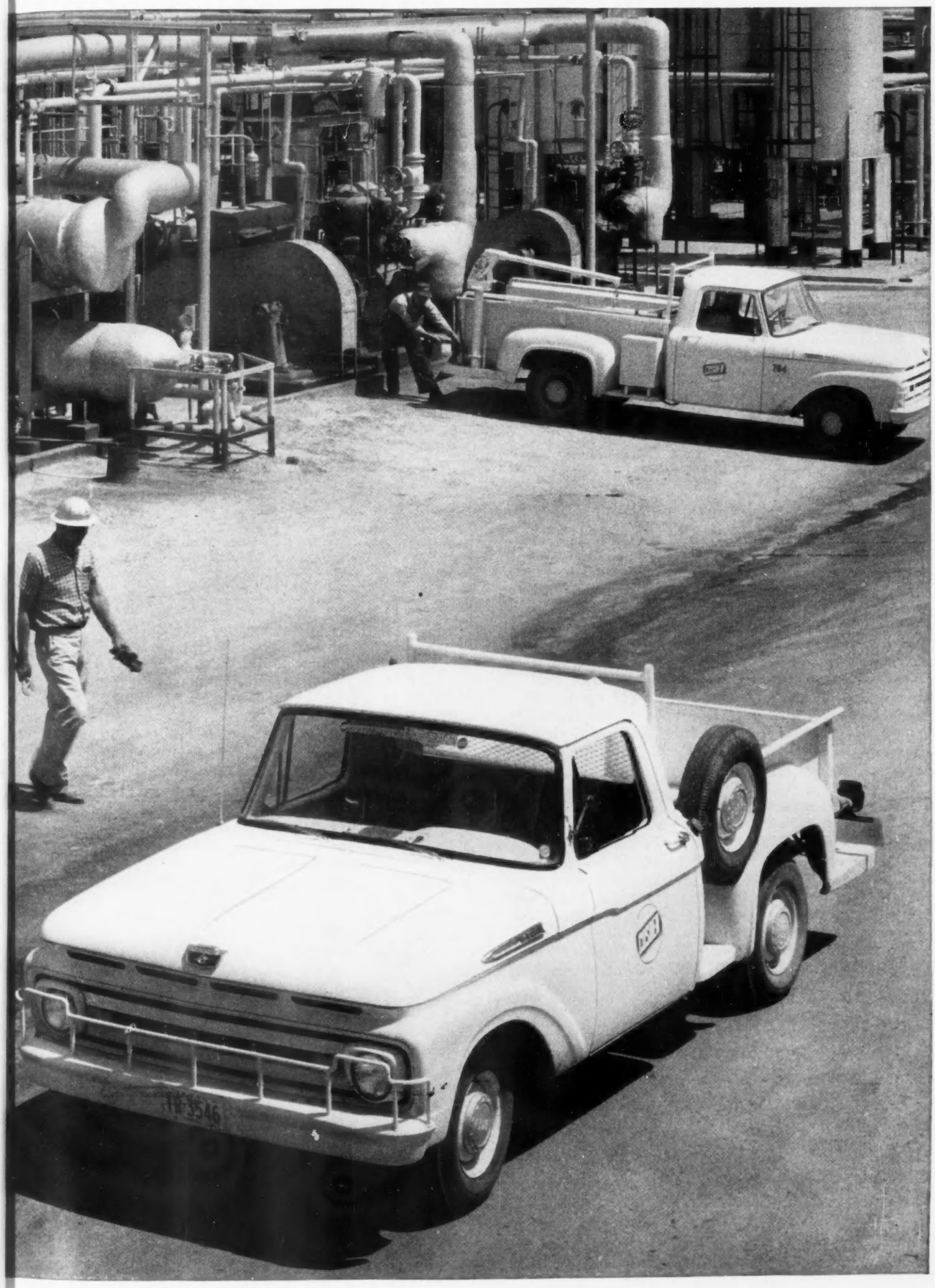
"Also, successive cost analyses have shown that we save money on maintenance and repairs by having all this work done at local Ford Dealer's. This system does away with our need for carrying an expensive parts inventory and reduces our own shop facility and manpower needs. Naturally, our 750 retail outlets do all the routine lubrication, washing and fueling for the fleet."

Solid testimony that Ford's full-time economy only starts with low price!

FORD TRUCKS COST LESS



PRODUCTS OF Ford MOTOR COMPANY



the case for using a SWACO D-GASSER on most of the wells you drill

Many operators and drilling contractors don't realize how D-Gassers can help them reduce the over-all cost of wells. By removing entrained gas and air from drilling mud after each circulation, the D-Gasser permits improved control of mud characteristics. As a result, many operators can profit from some of the following savings:

SAVES MUD AND CHEMICALS. If gas-cutting is encountered, the chances are good you can save on mud bills. The D-Gasser usually permits drilling without adding weighting material even though the well is "kicking" from drilled gas. It has been possible to keep mud weights more than a pound lighter than would have been possible without the D-Gasser. Over-treatment of mud (and the resulting stuck pipe and formation trouble) can be avoided when the D-Gasser is used. Trip gas and viscosity increases due to dissolved and entrained gas may be controlled without costly and time-consuming mud treatment.

SAVES LOST CIRCULATION MATERIALS. Since the D-Gasser often makes it possible to continue drilling while the well is "kicking", lighter mud can be used and lost circulation problems may be held to a minimum.

PERMITS FASTER, LOWER COST DRILLING. Drilling rates and/or footage per bit may be increased since light, low-solid muds may be used. Total drilling time may be reduced and fewer round trips may be required.

SAVES CASING. Frequently, operators avoid the expense of setting a long string just to evaluate a minor gas show. By eliminating the recirculation of gas, the D-Gasser prevents exaggerated impressions from minor shows. Occasionally, it has been possible to save an intermediate string when a D-Gasser is used.

SAVES WELLS. Many high pressure exploratory wells have actually been saved by the D-Gasser. Costly blowouts, fires and lost holes have been avoided. For full information on how the D-Gasser can help you, contact your nearest SWACO representative or write us direct.

SWACO

717 FT. WORTH NATIONAL BANK BLDG., FORT WORTH 2, TEXAS
Telephone: EDison 2-4433 Cable Address: "SWACO" Fort Worth

LOUISIANA: New Orleans, Lafayette
OKLAHOMA: Oklahoma City
•
TEXAS: Houston, Corpus Christi, Fort Worth, Kermit
NEW MEXICO: Farmington

WHY IT PAYS TO BUY WIRE ROPE MADE BY OIL COUNTRY SPECIALISTS

You get extra ton miles of service with Union wire rope products . . . because they are designed, tested and produced by specialists in oil country service. Union wire rope laboratories, foremost in this industry, conduct exhaustive field studies to improve performance, safety and service life. Union products are job-proved on the world's deepest wells under toughest operating conditions.

Your National Supply store carries complete stocks of Union wire rope products, including *Tuffy* rotary lines, sand lines, cut rope and slings.

These "ready to roll" stocks are immediately available and can be delivered with the other oil country supplies you buy from National Supply.

This combination of Union wire rope *quality* and National Supply *service* gives you the best buy in the oil country. You get prompt, immediate delivery by an oil country supplier who knows you and knows your problems.

See next pages for information on new National Type G Hook Blocks

NATIONAL

NATIONAL SUPPLY ANNOUNCES A NEW STREAMLINED TYPE G HOOK BLOCK

New National Type G hook blocks are the culmination of years of design development and testing in field applications. They are completely streamlined for safety and efficiency. The new hook blocks are now offered in four sizes, with ratings from 100 tons to 500 tons. Here are some of their outstanding features:

FULLY UNIVERSAL CONNECTION between hook and block. A crosshead is provided with integral trunnions extending through and supported by the side plates. Hook and block assemblies are quickly disconnected for shipment by pulling the crosshead pin.

BUILT-IN HYDRAULIC SNUBBER prevents bouncing of drill pipe stands when spinning out and consequent costly damage to tool joint threads.

CONSTANT TORQUE POSITIONER. This device, which is standard equipment, keeps the drill pipe elevator from rotating out of position when it is going up empty. Derrick man can latch the elevator easily and is less likely to miss stands.

IMPROVED TONGUE CONSTRUCTION. Each tongue has a smooth, uninterrupted bail contacting surface which is contoured to properly support and protect the swivel bail. Tongue of the hook block is automatically latched when the swivel is picked up and cannot be opened accidentally.

TAPERED ROLLER BEARING SHEAVES. Sheaves are independently mounted on double row, tapered roller bearings that reduce sheave friction to a minimum. Rope grooves are machined in accordance with A.P.I. recommendations and are flame hardened.

CONVENIENT ROTATION LOCK. Each hook block has a rotation lock that will either lock the body in any one of eight equally spaced positions or permit free rotation.

STREAMLINED DESIGN minimizes the possibility of the block's catching on finger boards or other mast or derrick projections. All screws, nuts and levers are recessed and securely locked in place for maximum safety.

These are just a few of the features of the new National Type G hook blocks. Get complete details by contacting your National Supply representative, or writing to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

NEW TYPE G HOOK BLOCKS

	330G100	435G175	540G250	545G350	650G500
Number of sheaves	3	4	5	5	6
Sheave O.D., in.	30	35	40	45	50
A.P.I. rating, tons	100	175	250	350	500

National is also currently offering a line of five separate H hooks with ratings similar to the new G hook blocks. The hooks have conventional bails which can be used with any traveling block having a regular lower clevis.

Type G Hook Blocks are made heavy so they will fall freely. Short design provides maximum crown block clearance.

Steel's Symbol of strength, long life, and economy

Steel

See next page for information on National Swivels

- **Uniflex Wash Pipe Packing Assemblies**
- **Quick-Seal Hose Connections**

TWO REASONS FOR SUPERIORITY OF NATIONAL SUPPLY SWIVELS

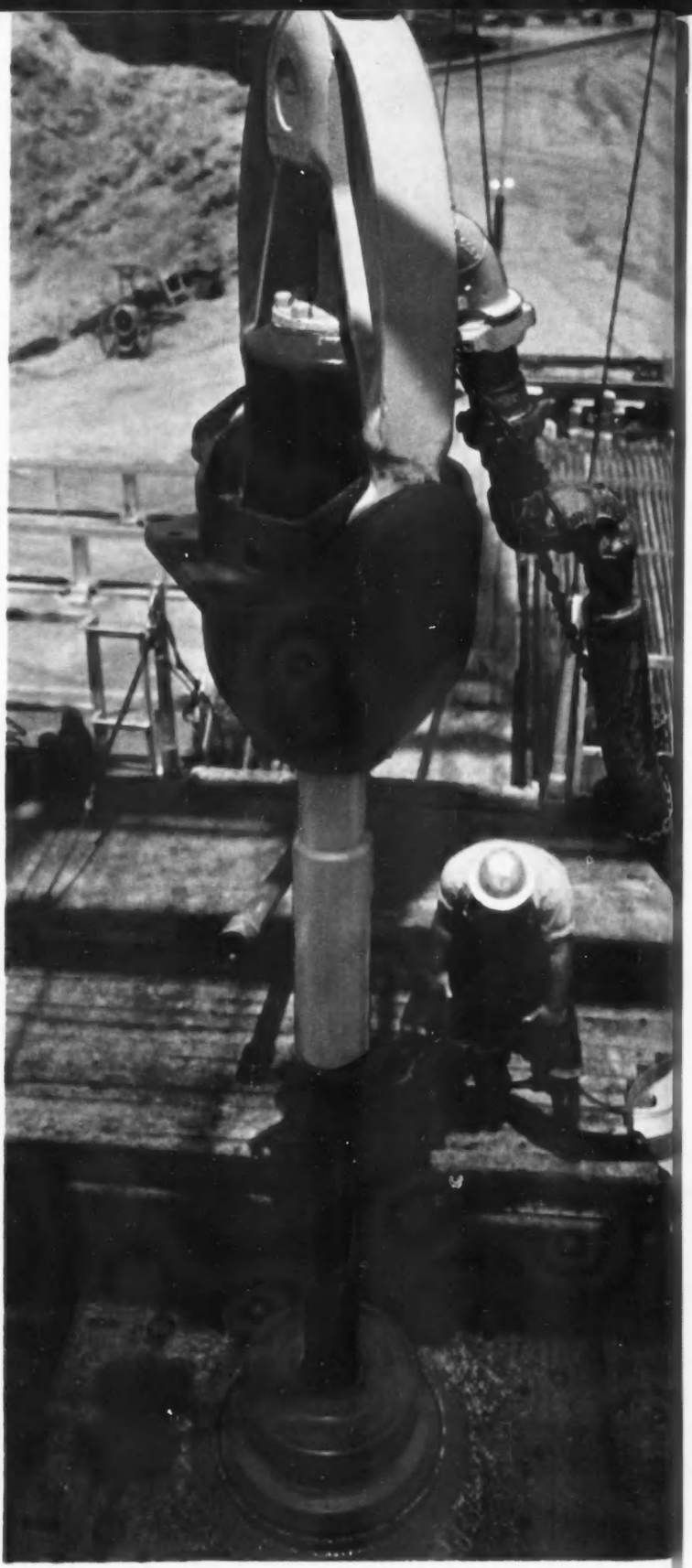
Field tested Uniflex wash pipe packing assembly of National Supply swivels incorporates a free-floating type wash pipe that provides an improved method of packing off the mud. Packing is unitized cartridge type. Light weight of the assembly and quick-breaking threads speed replacement. Assembly can be installed without removing gooseneck or hose connections.

Quick-Seal hose connection features large, quick-breaking threads and uniform sealing elements to withstand rugged use. Design eliminates one hose connection member. All parts are made of steel and plated to resist corrosion and thread galling.

The Uniflex wash pipe packing assembly and the Quick-Seal hose connection are outstanding features of seven National swivels having comparative dead load ratings from 82 to 500 tons — and depth ranges extending from 1,000 ft. to 24,000 ft. There is a superior quality National swivel to meet any drilling requirement. Let your National Supply representative give you details, or write to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

National Supply also offers the new, small T-12 swivel, with an A.P.I. rating of 25 tons at 100 r.p.m. and a comparative dead load rating of 50 tons. It is used with small portable or trailer mounted rigs in exploratory, slim hole and shallow drilling, or on workover jobs.

Features are: • High strength-to-weight ratio • Low center of gravity • Precision line bored bail • Opposed Timken tapered roller bearings for true axial alignment.



Low center of gravity in streamlined National Supply swivels gives you greater stability in handling, easier and faster connection of sub to kelly.

ARMCO National Supply Division

"Matched Tools for Unmatched Performance"

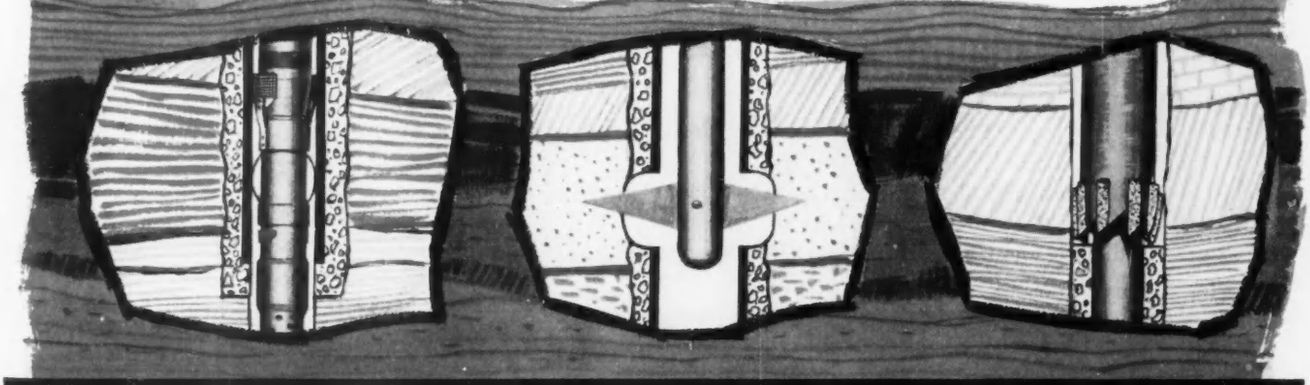
WHAT 42 YEARS OF SERVICE "KNOW-HOW" MEANS TO YOU

Whether your needs call for setting a liner, notching the formation, washing over stuck Drill Collars or any other service job, *BAASH-ROSS* service *"know-how"* coupled with top-engineered tools, such as the Power Swivel, means you are assured . . .

- That experienced servicemen will do the job right
- That the job will be done in the shortest time
- That you will realize the maximum in safety, quality and accuracy

These factors total up to the ultimate in *SERVICE PERFORMANCE* which means *SAVINGS* to you.

ONCE USED . . . ALWAYS DEMANDED



OVERSHOT

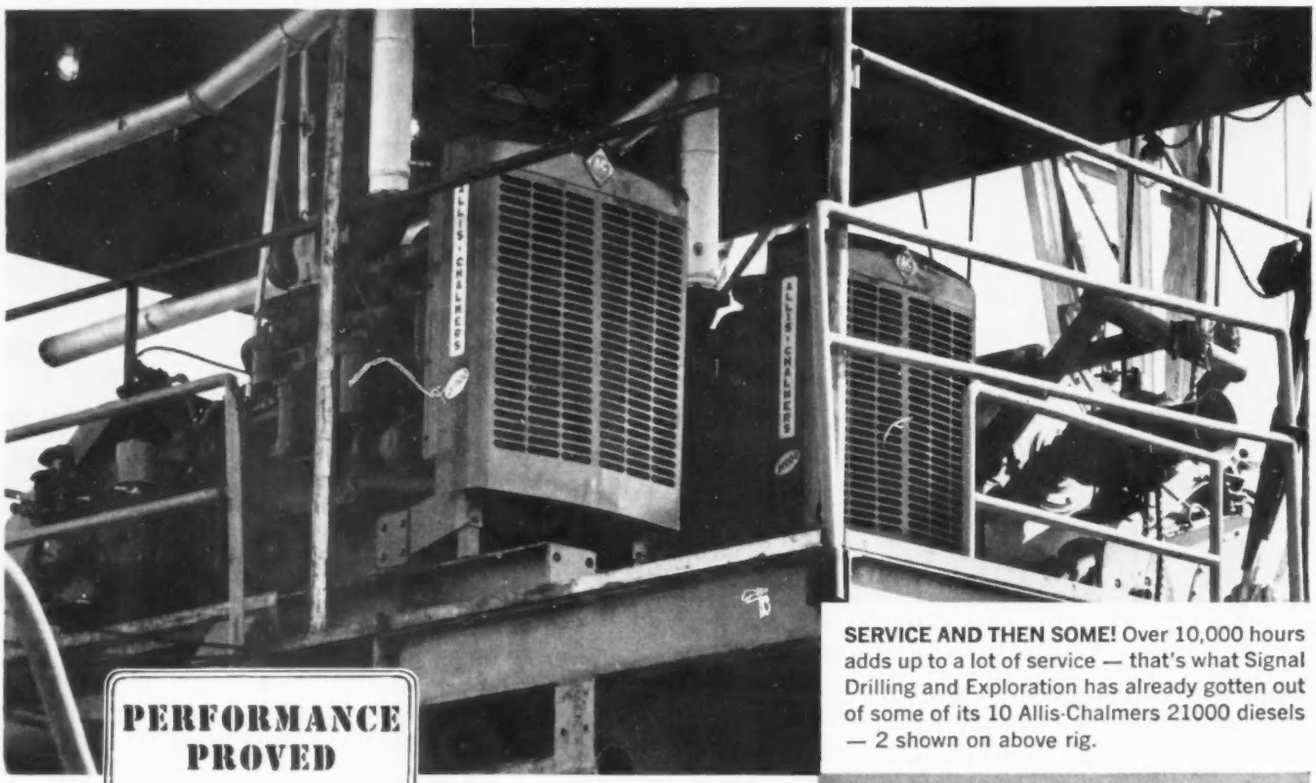
In addition to extensive service work, Baash-Ross fishing and drilling tools are available for rent. Be ahead by calling us for your Rental or Service needs.

INTERNAL PIPE CUTTER

BAASH-ROSS
DIVISION OF JOY MANUFACTURING COMPANY
General Offices: Houston, Texas

OUR 42d YEAR OF PROGRESS

JOY



PERFORMANCE PROVED

SERVICE AND THEN SOME! Over 10,000 hours adds up to a lot of service — that's what Signal Drilling and Exploration has already gotten out of some of its 10 Allis-Chalmers 21000 diesels — 2 shown on above rig.

Allis-Chalmers 21000's are "The most dependable diesel power at minimum cost for operation and maintenance"

. . . says Signal Drilling Co.

"Our 10 Allis-Chalmers 21000 series diesel engines have proved themselves far superior to those they replaced on our rigs. We have experienced almost no rig downtime because of engine trouble or failure, and their cost of maintenance is less than 25% of the previous engines we used. They have an unusually fast response to throttle acceleration with almost unbelievable power proportionate to size and weight.

"Our drillers, pushers and motormen have been extremely pleased with the trouble-free operation experienced in addition to the extra power output which we have obtained. They are a fine combination of minimum weight and maximum dependable rig power in an area where altitudes and climate are most demanding."

For full information on "thousand series" diesels and the names of other users, see your Allis-Chalmers engine dealer. Allis-Chalmers, Milwaukee 1, Wisconsin.

BO-12

ALLIS-CHALMERS

***POWER* FOR A GROWING WORLD**

Now profit from Selective Completions

Simplify Zone Isolation Tests with Camco Magnasleeve

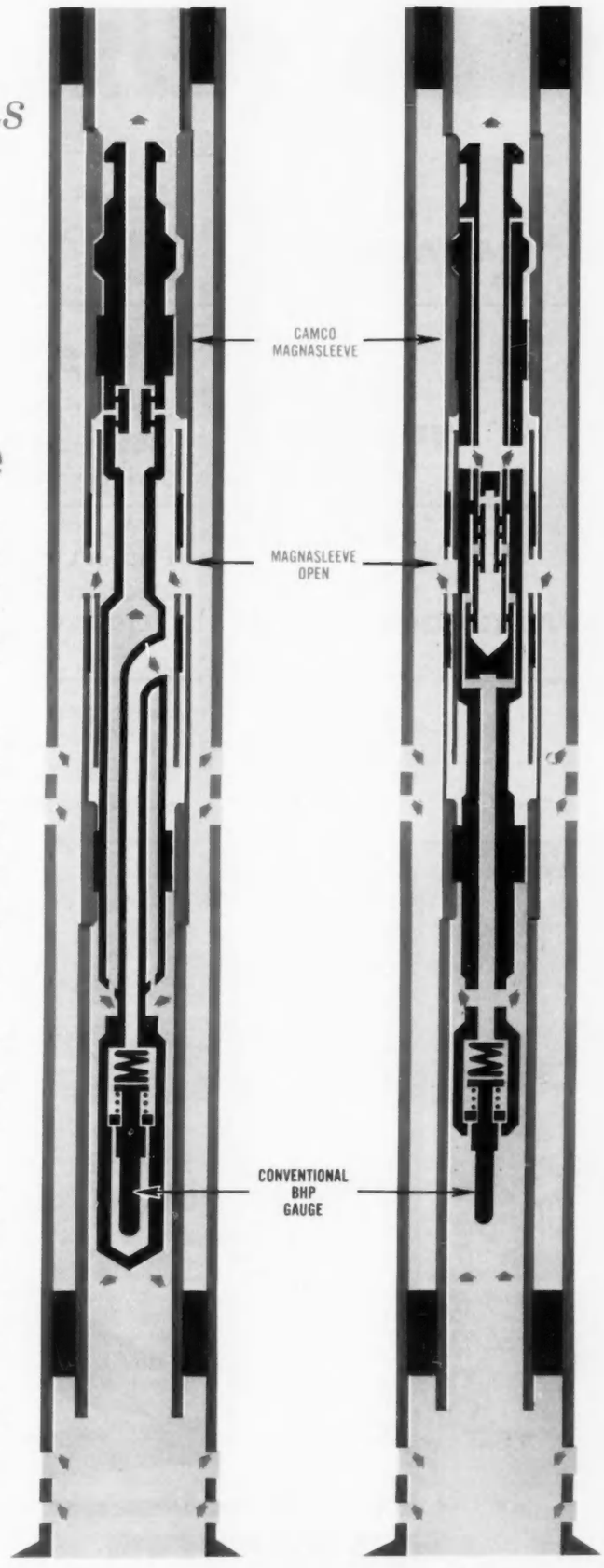
Selective completion of a well opens a multiple number of pay zones which are then produced selectively through the same tubing string. This method can earn profits for you by drastically reducing tubing and wellhead equipment costs, by eliminating recompletion costs, and by facilitating the depletion of short-life reservoirs.

If the problem of obtaining conclusive zone isolation tests has deterred you from adopting this profitable completion technique—delay no longer. For simple, practical BHP tests are now made possible by Camco's new **Magnasleeve** to prove that your pay zones are segregated and establish the reliability of operating data from each zone. The Magnasleeve—a combination of Camco's field-proven **Magnaset Nipple** and **C Sliding Sleeve**—greatly simplifies these tests, as illustrated—thanks to the **selective setting** principle of Camco Magnaset.

The Magnasleeve will also serve as a landing nipple in which a Magnaset Lock with affixed subsurface production controls can be set, and as a sideport nipple to permit the use of separation tools and sidedoor chokes.

As many as six Magnasleeves can be installed in a single tubing string. Subsurface controls, run and retrievable by solid steel wire line, are automatically set in the desired Magnasleeve by the surefire electronic Magnaset method. Dependable-shifting Magnasleeves are selectively opened and closed with standard shifting tools.

Install Camco Magnasleeves and prepare to profit from selective completions. For more information on Magnasleeves and their applications, call your Camco representative or write



UPPER ZONE: Static BHP recorded.

LOWER ZONE: Producing.

UPPER ZONE: Producing.

LOWER ZONE: Static BHP recorded.

CAMCO INCORPORATED

Box 14484
Houston 21, Texas

CAMCO, LIMITED, Belfast, U.K. – CAMCO DE MEXICO, S.A., Mexico, D.F.

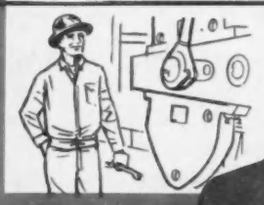
What LUFKIN MEANS

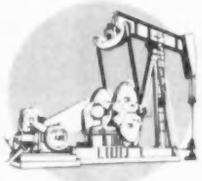
TO MANAGEMENT
- Lowest Operating Costs
- Least Down Time
- Highest Resale Value

TO THE ENGINEER
- Best Geometry — Lowest Torque Factors
- Largest Bearings and Shafts
- Most Rugged Gear Reducers
- Greatest Dependability

TO THE WAREHOUSEMAN
- Fastest parts delivery
- Best availability of parts regardless of age of unit.

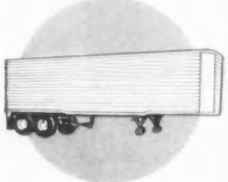
TO THE PUMPER
- Best and Fastest Field Service
- Easiest to operate
- Least attention necessary



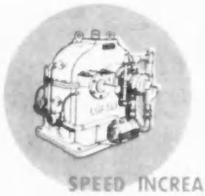


PUMPING UNITS

GAS ENGINES



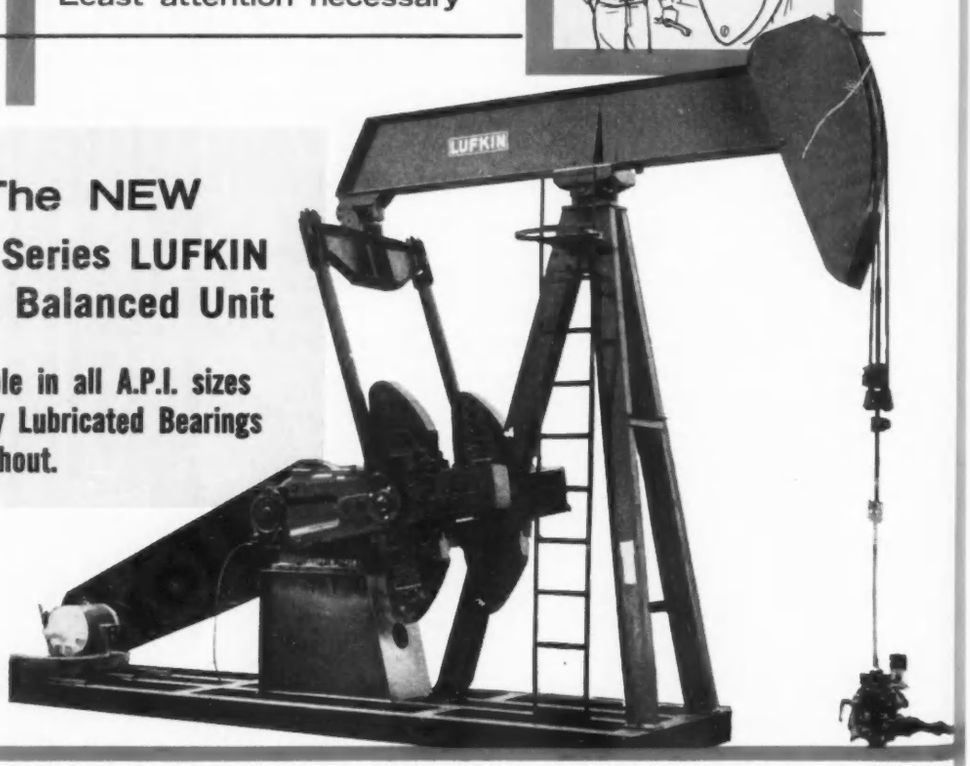
TRAILERS



SPEED INCREASERS AND REDUCERS

The NEW A.P.I. Series LUFKIN Crank Balanced Unit

Available in all A.P.I. sizes Factory Lubricated Bearings Throughout.



LUFKIN FOUNDRY & MACHINE COMPANY

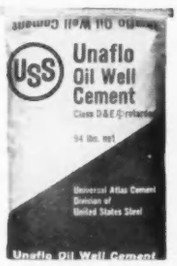
LUFKIN, TEXAS

Branch Sales and Service

Houston • Natchez • Corpus Christi • Lafayette • Dallas • Kilgore • Odessa • Hobbs • Great Bend • Denver • Shreveport
Wichita Falls • Los Angeles • Bakersfield • Casper • Oklahoma City • Sidney • Midland • Farmington • Tulsa • New York
Maracaibo, Venezuela • Anaco, Venezuela • Buenos Aires, Argentina • Talara, Peru • Rio De Janeiro, Brazil • La Paz, Bolivia

Lufkin equipment in Canada is handled by
THE LUFKIN MACHINE CO., LTD., 9950 65th Avenue, Edmonton, Alberta, Canada, Regina, Saskatchewan, Canada

For more data on advertised products, use cards, last page.



UNAFLO OIL-WELL CEMENT

compatible with additives for slurry weight control

Another field report proves Unaflo oil-well cement compatible with additives for light- or heavy-weight slurries ranging from 12 to 19 lbs./gal.

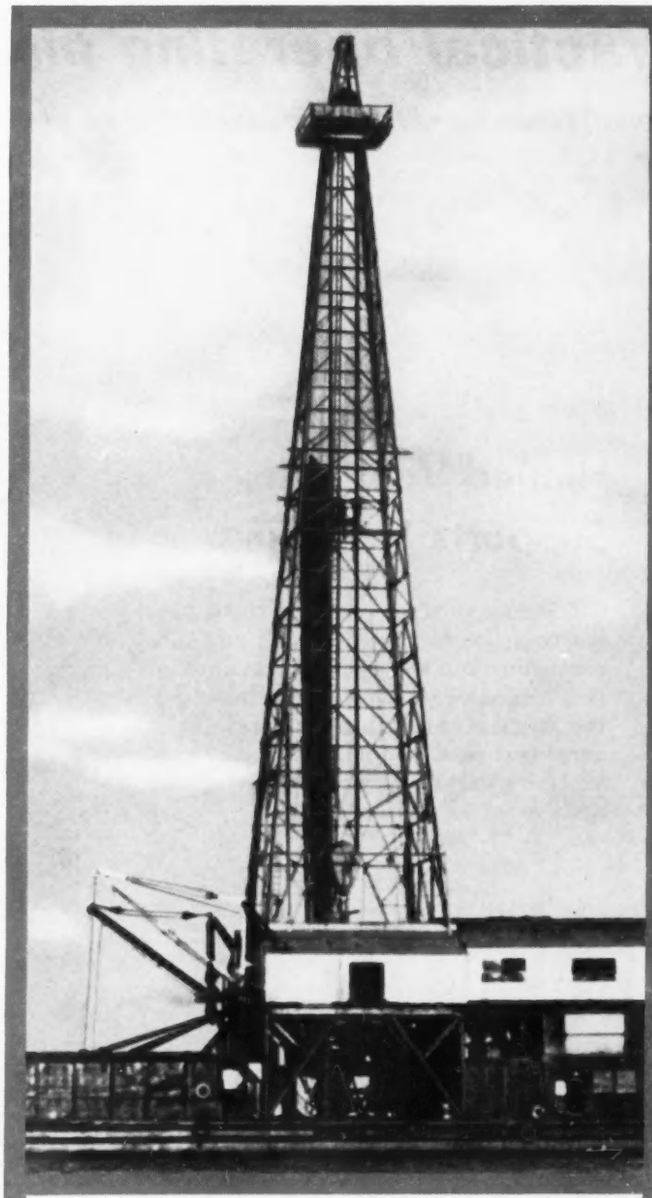
For cementing casing or liner, squeeze cementing, plug-backs or recementing, UNAFLO cement slurries pump easily and set hard to provide an adequate seal. Its retarded set sustains high fluidity despite high temperatures and pressures. This allows time for proper placement plus a margin of safety for delays or emergencies.

For more information, write Universal Atlas Cement, 100 Park Avenue, New York 17, N. Y.

"USS" and "UNAFLO" are registered trademarks

OFFICES: Albany · Birmingham · Boston · Chicago · Dayton · Fort Lauderdale · Kansas City · Milwaukee · Minneapolis · New York · Philadelphia · Pittsburgh · St. Louis · Waco

Universal Atlas Cement
Division of
United States Steel



U-166

CEMENTING DATA

Contractor: Rowan Drilling Co., Inc., Ft. Worth, Texas

Job #1 – String of 9⅝" O.D. -N80 and P110 casing run in a 12¼" hole to 14,095', cemented with 1,500 cu. ft. of lt. wt. slurry composition (811 sacks UNAFLO plus 406 cu. ft. Stratacrete 6 plus 4% gel by weight of cement). Slurry wt. 13.3 lbs./gal. Drilling mud wt. 11.8 lbs./gal Log temp. 216°F. Est. static BHT 248°F. Final pressure 2,000 psi. Full returns accomplished during 1 hr. and 40 minutes mixing and pumping of the slurry to place behind the pipe.

Job #2 – Drilling 8⅜" hole below 9⅝" casing at 14,483' using 17.9 mud, well started losing mud and kicking. Retrievable-type packer set in the 9⅝" casing at 14,006' and the open hole was squeezed using 1,000 sacks of UNAFLO plus .3 of 1% HR4 Retarder. Max. squeeze pressure of 5,200 psi resulted with 825 sacks out in the formation. Mixing and pumping time 2 hrs. and 7 minutes. Est. static BHT 276°F.

Job #3 – 856' of 6⅝" O.D. P110 liner bottomed at 14,895', cemented with 250 cu. ft. of a weighted slurry composition consisting of 205 sacks UNAFLO cement plus 8,000 lbs. Ilmenite Ore plus .3 of 1% HR4 by weight of cement. Drilling mud weight 18.5 lb. gal. Log. temp. 245°F. Est. static BHT 282°F. Full returns accomplished during 55 minutes mixing and pumping of the slurry.

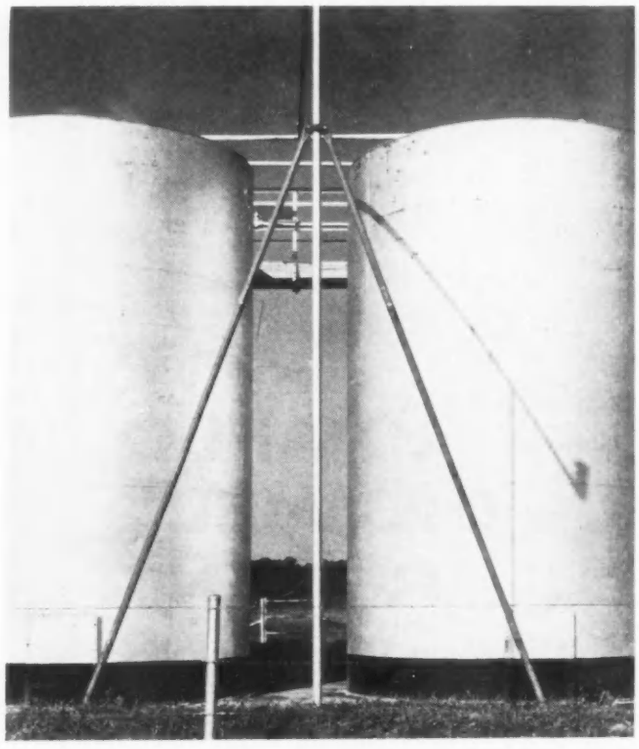
For more data on advertised products, use cards, last page.

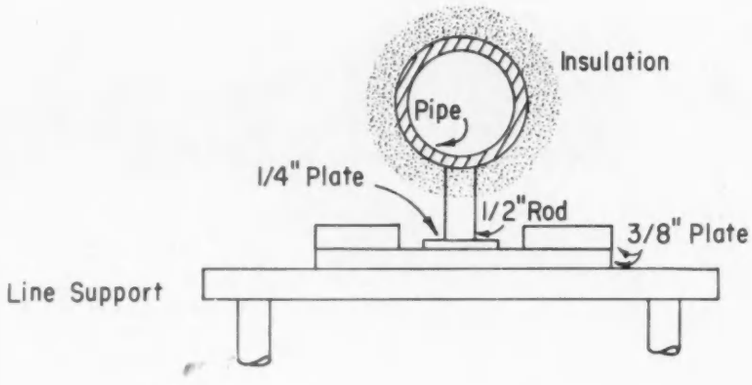
Practical operating hints

*These **How-To-Do-It** ideas can save you money*

Hinged Vent Line Supports Save Time

Installation of an elevated stock tank gas vent line can be a difficult and time consuming job. This operator has installed two hinged supports as shown instead of the usual vertical pipe support. With gang personnel handling each side support, the elevated line can be quickly and easily raised into place.





How to Support Insulated Lines

Insulation used on field pipe lines often is damaged due to movement of the line during excessive changes in temperature. Usually, the soft insulating material is torn at the pipe support points. This simple installation will prevent such occurrences.

A flat section of ⅜-inch steel plate is welded across the top of the support and additional pieces are welded along each side as shown in the drawing. A ½-inch rod is welded both to the pipe, prior to insulation, and to a small piece of ¼-inch plate which rests on the ⅜-inch plate support. The insulation never comes in direct contact with the pipe support. When the pipe does move, the ¼-inch plate moves between the ⅜-inch guides.

Dope Bucket From Thread Protector

A large casing thread protector, short length of sucker rod and light gage plate can be used to field construct a sturdy dope bucket. The plate is welded to the end of the protector and forms the bottom of the bucket.

The "M" shaped length of sucker rod serves as both a handle and pipe stand.

Continued on Page 48

OUR
25th
YEAR
Season's
Greetings
from
Smith TOOL CO.

WELL COMPLETED

WITH NO MAINTENANCE
NO LUBRICATION
GROVE VALVES

Whatever the completion: single, dual, triple; whatever the service: master, wing or flow line; wherever the location: prairie, swamp or platform, Grove production valves serve you best. Designed and proved in highest pressure wells, Grove production valves offer exclusive "double-barrier" seal. First—positive metal-to-metal seal between inner seat rings and parallel sided gate; second—protected o-rings that seal and squeegee the gate clean and smooth for fast, easy open and close. For master valve service: Grove standard G-2, Balanced Stem, Dual Block, Recessed Body valves and compact Grove Valv-Pak. For wing valves: G-2's and new compact G-6's. Grove V-2's, VL-2's for flow line service. Don't just look at the selling price! Investigate how Grove production valves eliminate maintenance and lubrication costs!

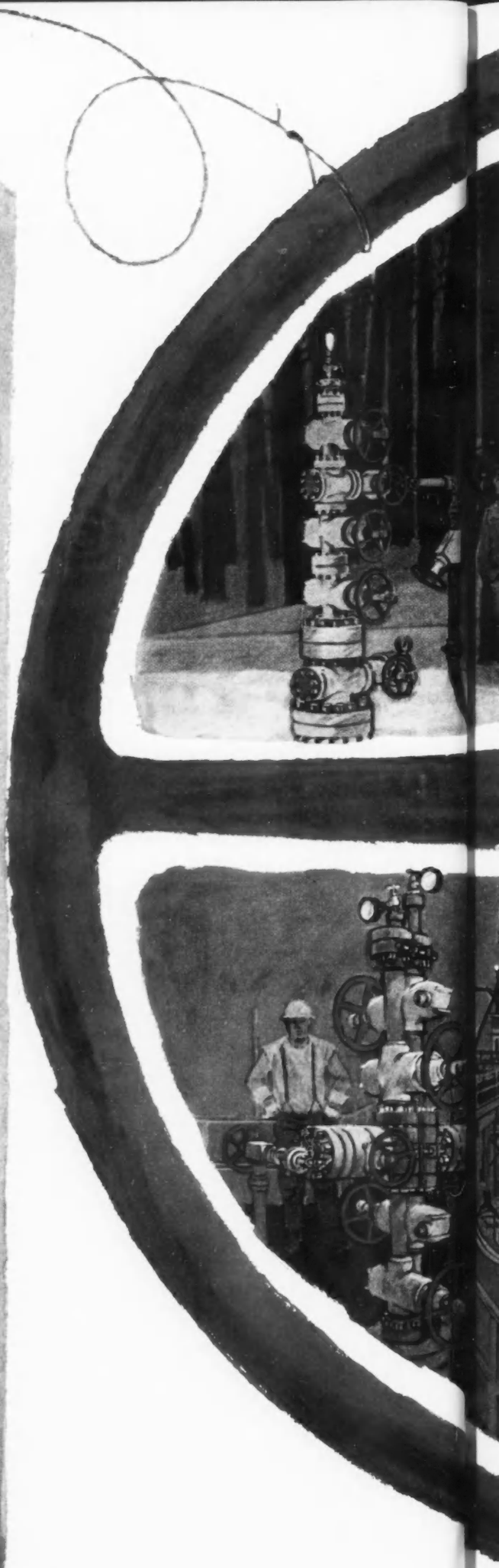
GROVE PRODUCTION VALVES

GROVE VALVE AND REGULATOR COMPANY

a subsidiary of Walworth

6529 Hollis Street, Oakland 8, California

Offices throughout the U.S. and in Western Canada

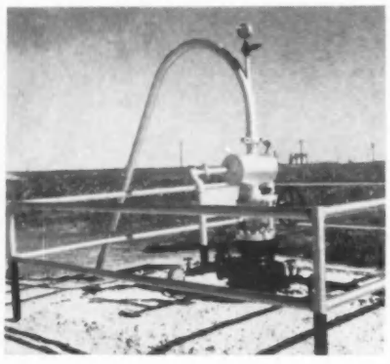


GROVE

Strong Back Reinforces Two-Pole Mast

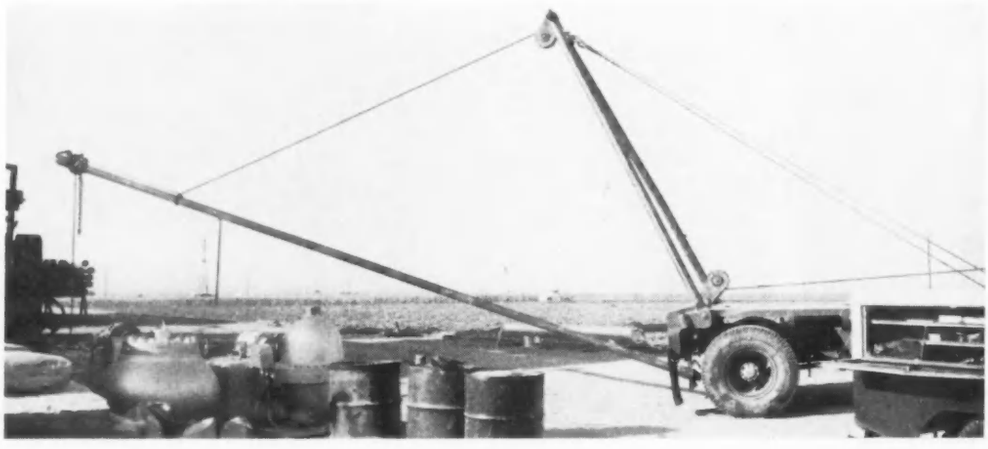
While hoisting two-pole telescoping masts, undue strain is placed on the mast just above the fulcrum point. During the initial stages of the pull, the structure is top heavy and could cause permanent deformation of the two legs.

To alleviate this condition, a strong back has been installed as shown. Either hog-rods or sucker-rods can be used with turnbuckles supplying the tension. If more tension is needed, the turnbuckles may be made up tighter.



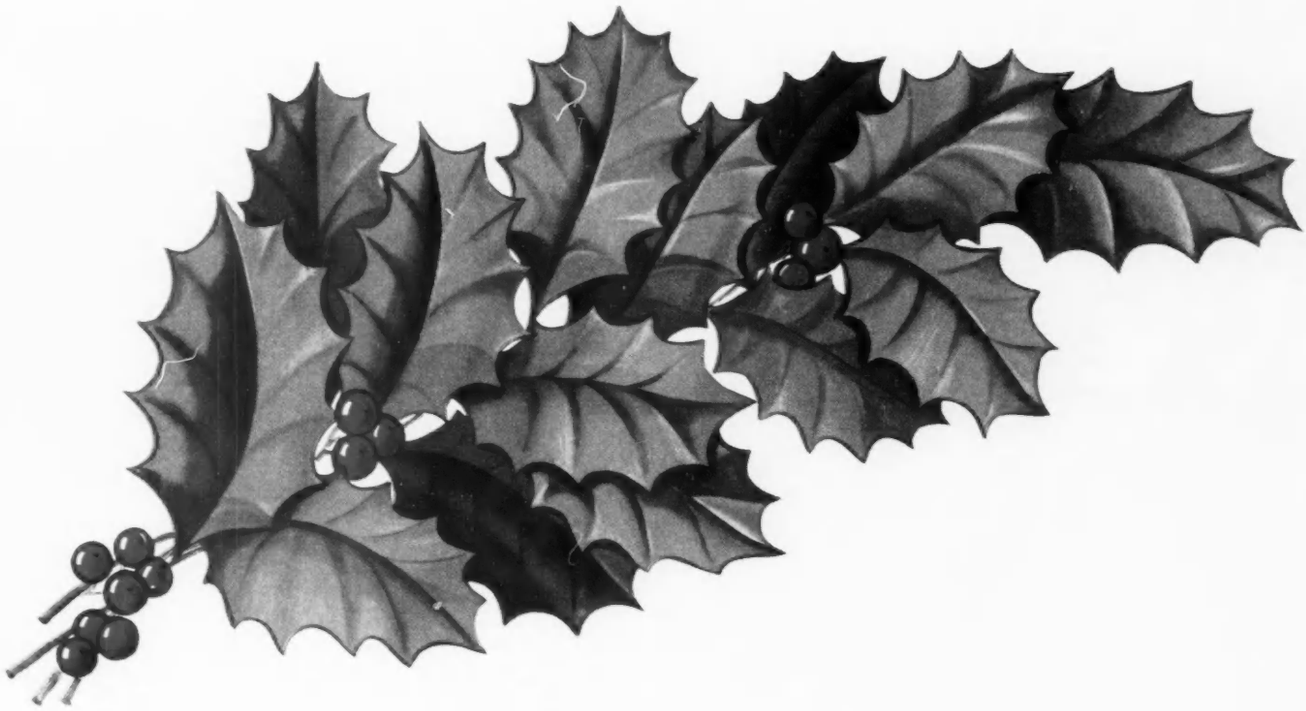
Prevent Freezing of Gas Lift Supply Line

Freezing of high pressure supply gas lines to artificial lift wells can be prevented by heating input gas in a heat exchanger mounted on the wellhead. The well shown produces large quantities of water and produced fluid is consequently very hot. By running the 4-inch flow line through the field constructed heat exchanger, enough heat is transmitted to the input gas to prevent freezing in the choke located on the casing wing. In addition, this type installation imposes no changes in flow direction or restrictions on produced fluid since the discharge flow line remains relatively unrestricted.



Hook-Up Provides Extra Reach for A-Frame

A handy, cost-saving idea sometimes used by experienced A-frame truck operators to obtain additional "reach" in inaccessible places around the rig entails only a joint of tubing or drill pipe and the know-how in rigging it up. Illustrated is one such hook-up that was used in overhauling and replacing gears in the power end of a large slush pump. The pump's position prevented access by the normal reach of the A-frame. A heavy hook, dropped a foot or two below the bed at the rear of the truck, is inserted into the end of the joint of tubing. The winch line, with a hitch around the joint near the far end as shown, is hooked into the other end of the arm. Taking up or letting out the winch line adjusts the pole height. For many jobs this method provides a quick, inexpensive way of lifting hard-to-reach loads and may save the cost of a crane.

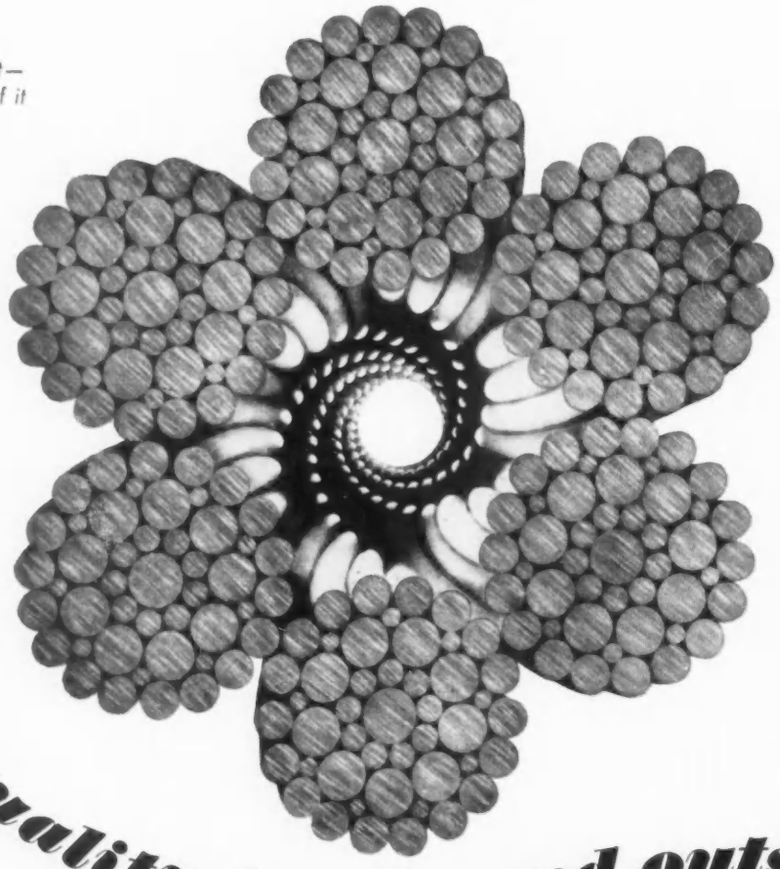


Greetings

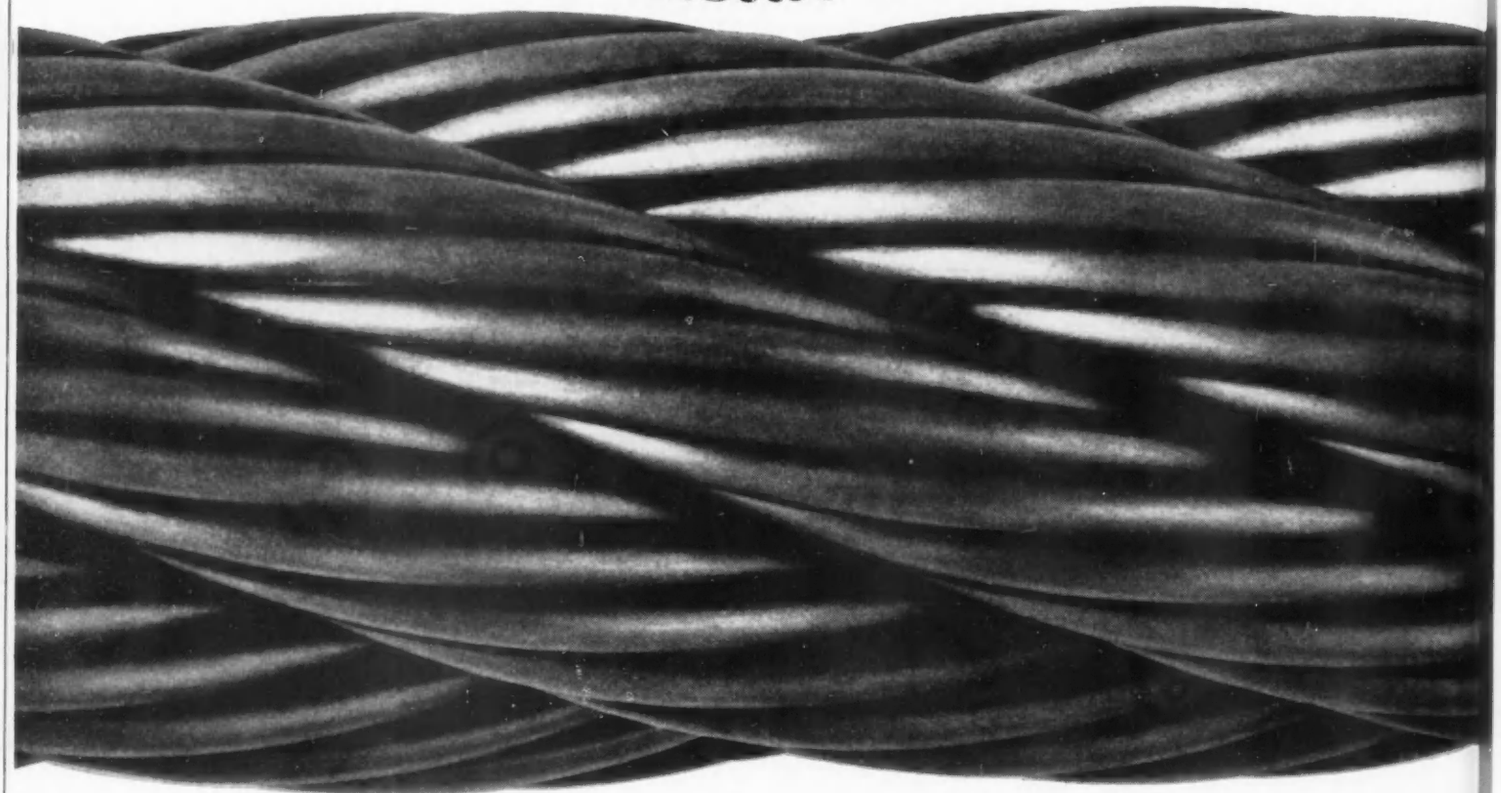
THE FOUNDATION OF ALL BUSINESS IS FRIENDSHIP AND WITH EACH HOLIDAY SEASON IT GIVES US PLEASURE TO EXTEND OUR BEST WISHES TO THOSE WHOSE FRIENDSHIP WE CHERISH.

THE Bovaird SUPPLY COMPANY

We put a lot of work into it—
You get a lot of work out of it



quality inside and outside



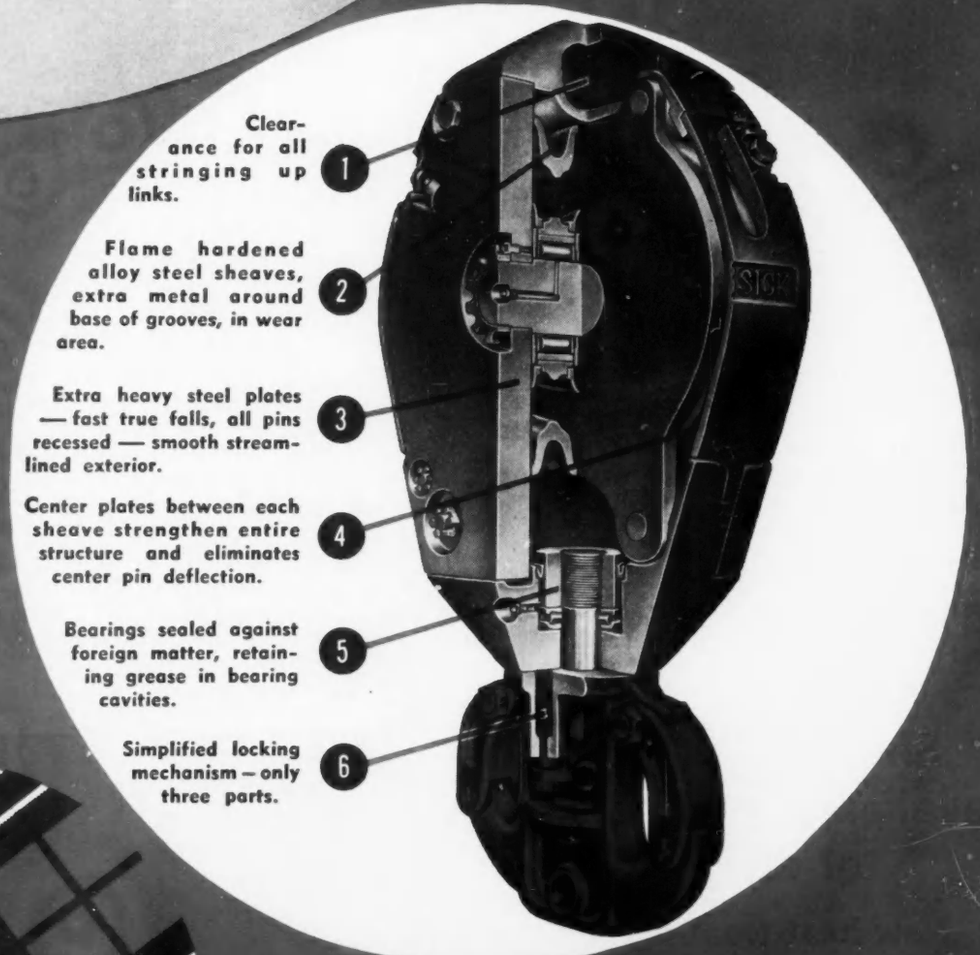
Two important angles on wire rope savings: the *quality* and *uniformity* Roebling builds all the way through Royal Blue Wire Rope. They give you a big, extra margin of service through every kind of wear and tear — and combine to make extra strong Roebling Royal Blue the toughest wire rope you can buy. Find out more from your wire rope distributor, or write for free booklet to Roebling's Wire Rope Division, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corp.

McKISSICK BUILDS A BETTER

TUBING BLOCK

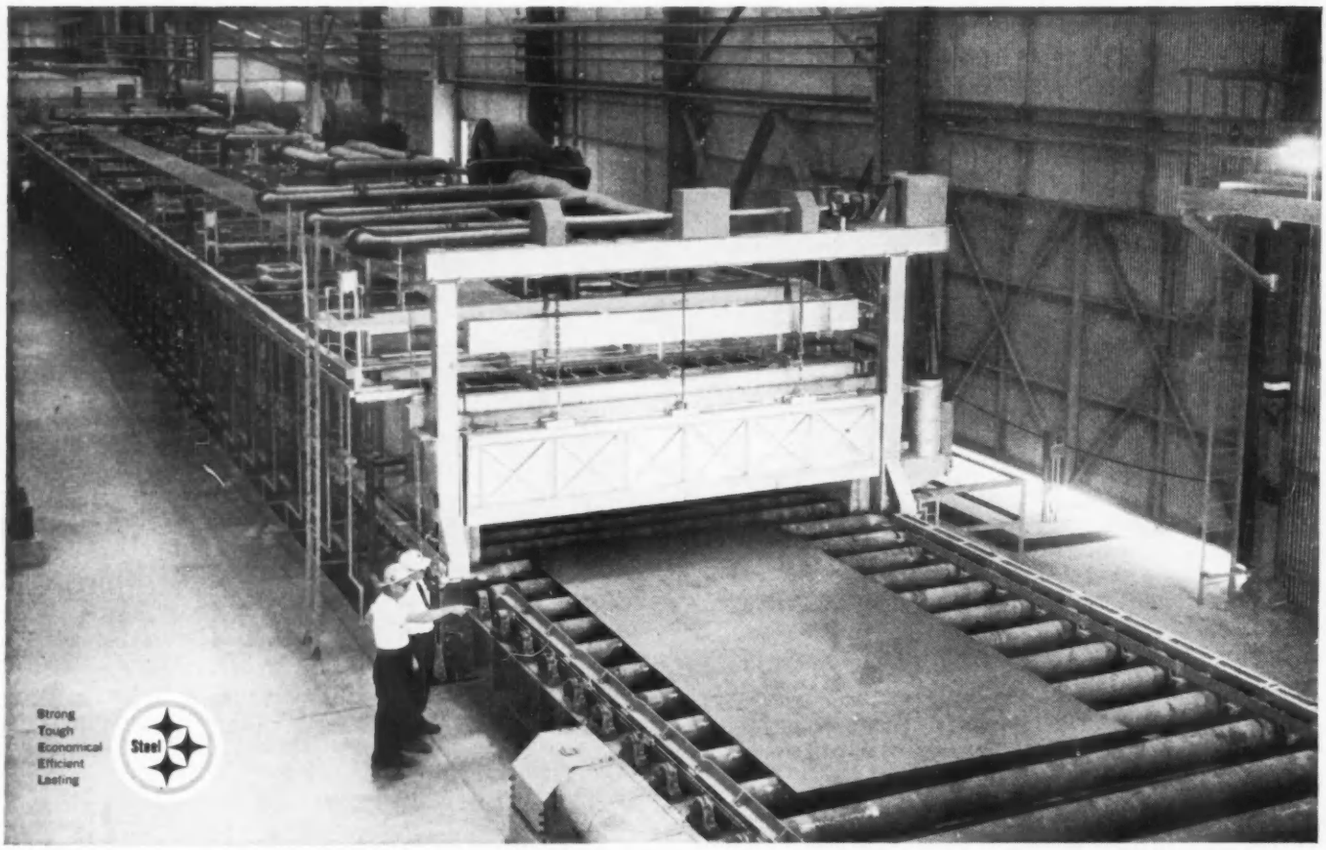


1. Clearance for all stringing up links.
2. Flame hardened alloy steel sheaves, extra metal around base of grooves, in wear area.
3. Extra heavy steel plates — fast true falls, all pins recessed — smooth streamlined exterior.
4. Center plates between each sheave strengthen entire structure and eliminates center pin deflection.
5. Bearings sealed against foreign matter, retaining grease in bearing cavities.
6. Simplified locking mechanism — only three parts.

McKissick

McKISSICK PRODUCTS CO.
Drawer 768 • Tulsa, Okla.

Division of
AMERICAN
HOIST



Completion of this new heat-treating line in Sheffield's Houston plant marks a new era for industry served by Sheffield from the Southwest. The new line shown has the capacity to heat-treat all gauges and sizes of plates rolled on the plant's plate finishing mills. It produces quenched and tempered or normalized plates. It is also designed to handle the wider and heavier plates which will be rolled in the Houston plant's new 160-inch combination slab and plate mill—to be completed in 1962.

Sheffield now makes available a complete line of alloy steels

New heat treating facilities now in operation

This is one of the most modern heat treating lines in the country. With this addition, Sheffield's facilities are now complete for processing all types of alloy steel including new SSS-100. This is the remarkable new Sheffield alloy steel which makes it possible to design with lighter components without sacrificing strength. For more information write **Sheffield Division, Armco Steel Corporation, Attention Alloy Sales, P.O. Box 3129, Houston 1, Texas.**

SHEFFIELD
Heat Treated Carbon and Alloy Steels

The ultra-modern group of electronic devices you see above regulates temperature, pressure and timing in Sheffield furnaces automatically. Plates are quenched in water, then re-heated in the tempering furnace. An operator checks the entire process by closed-circuit television which can "see" the inside of the furnaces.

ARMCO Sheffield Division

red bag or blue bag?

(One of them can help you get the mud viscosity you need)

In a low-solids mud area like West Texas or the Rockies, you need a CMC that will build mud viscosity as well as reduce fluid loss.

That's the red bag – Du Pont's High Viscosity "Qualex". No other CMC can build mud viscosity as well.

In a high-solids mud area like the Gulf Coast, you need a CMC that will not boost the viscosity of your mud, while still maintaining fluid loss control.

That's the blue bag – Du Pont's Low Viscosity "Qualex". When you use Du Pont Low Viscosity "Qualex" for fluid loss control, you save the cost of other additives since you don't have to use thinners or water back the mud to compensate for viscosity caused by the CMC.

Your mud dealer can supply you now. Which will it be – red bag or blue?

(Your dealer also has Du Pont "DM" grade CMC, in both high and low viscosities.)

CMC

DU PONT

Better Things for Better Living . . . *through Chemistry*

SCIENTIFICALLY DESIGNED IRREGULAR TOOTH PATTERN on GLOBE SS 2 2-CUTTER JET BITS make MORE HOLE FASTER IN SOFT FORMATION

The irregularly spaced teeth breakup any tendency to form a pronounced pattern on bottom. Globe 2-Cone Bits dig formation out like a shovel. Because they leave more space in the hole for circulation, their long teeth enable Globe SS 2 Bits to give consistently outstanding hole digging performance.

WHEREVER THEY ARE USED
GLOBE "TASK-TYPE" ROCK BITS
STAY ON BOTTOM LONGER

GLOBE SS 2 JET ROCK BITS

are especially designed for use where heavy, sticky, unconsolidated materials are encountered. In such formations, their unique, long, wide spaced teeth are most effective for tearing into sticky formation and gouging and shoveling out gumbo. And no other bit of comparable size has such large accurately machined precision bearings, as GLOBE 2-Cutter "Task-Type" Jet Bits.

GLOBE OILTOOLS

GLOBE OIL TOOLS CO.
Main Office and Plant: LOS NIETOS, CALIFORNIA
Branches maintained in all principal drilling areas

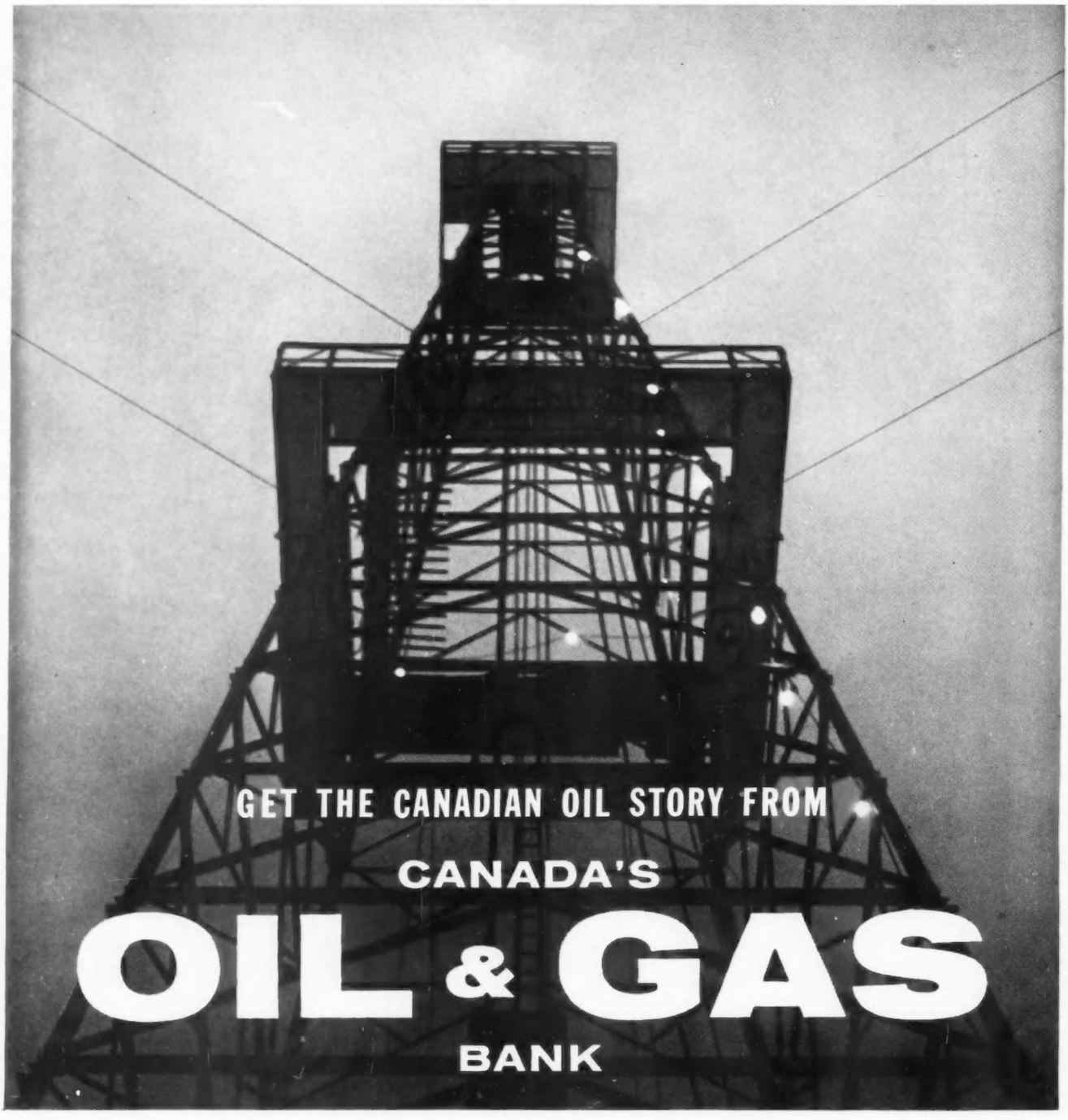
Single action Colt owned by early Texas Ranger

Maintenance often meant the difference . . .

RELIABLE SERVICE IS NO ACCIDENT ■ SCHLUMBERGER TAKES EVERY PRECAUTION TO MINIMIZE DOWN-TIME IN THE FIELD—FROM PRE-DEPARTURE CHECKS ON EVERY JOB TO 10,000 MILE MAJOR OVERHAULS—FROM MONTHLY CABLE MEASUREMENT AND INSPECTION TO MAINTENANCE AND MODERNIZATION OF ELECTRONIC TOOLS ■ RECORDS OVER THE YEARS PROVE SCHLUMBERGER'S THOROUGH AND NEVER-ENDING PREVENTIVE MAINTENANCE PROGRAM MEANS BETTER SERVICE AND A MINIMUM OF LOST RIG-TIME FOR YOU—THE OPERATOR.

SCHLUMBERGER LEADS IN PREVENTIVE MAINTENANCE

HOUSTON



If you are interested in Canada's expanding oil and gas industry, you will find the Royal's *Special Bulletin Service* of value. These bulletins, issued by our Oil and Gas Department, are frequently revised and contain information on all important aspects of the industry — regulations, tariffs, financing, statistics and kindred topics. For copies of current bulletins, write to our Dallas representative, Mr. T. C. Marshall, Rm. 1523, 300 N. Ervay St., Dallas 1, Texas; or to The Royal Bank of Canada, Oil and Gas Dept., 409 Eighth Avenue W., Calgary, Alta.

This service is but one of many useful functions performed by our Oil and Gas Department. Manned by practical "oil bankers" with long experience in the field, it is well organized to assist oil and gas men.

We do not provide information on oil securities.

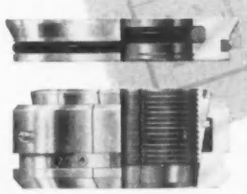
THE ROYAL BANK OF CANADA

Head Office: Montreal • New York Agency: 68 William St., New York 5, N. Y. • Dallas Representative: T. C. Marshall, Room 1523, 300 N. Ervay St.
Assets exceed 4 billion dollars • Over 1,000 Branches in Canada, the Caribbean Area and South America • Offices in New York, London and Paris

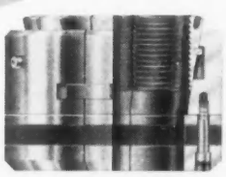
1961 Brought you these NEW O·C·T products

Again this year your needs for new types of wellhead equipment, to use with improved completion techniques, have kept us busy.

Here are the new designs introduced by O.C.T. during 1961.

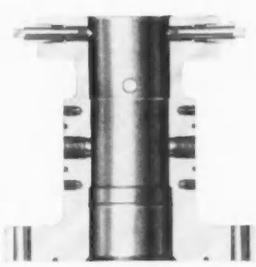


C-21 Casing Hanger — The C-21 consists of slips, slip bowl, and a floating seal ring that provides positive annulus packoff.

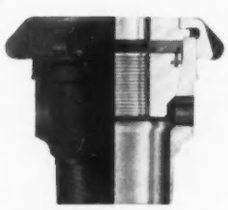


C-22 Casing Hanger — This hanger features a single-unit sealing element, slip bowl and slips; automatic seal; and load-carrying strength greater than the pipe's joint strength.

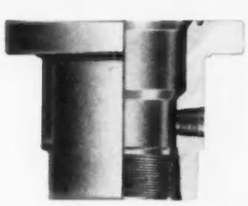
Tubingless Completion Wellheads — These wellheads give you maximum flexibility, with interchangeable slip and threaded hangers, a variety of casing heads, and master bushings to allow assembling any desired single or multiple completion.



T-C Multi-Head — This is a versatile tubing or casing head that accepts 13 different threaded and slip-type hangers for single, dual, or triple completions.

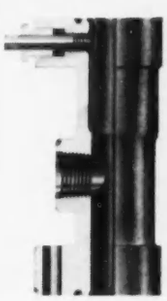


Independent Wellheads — These forged steel, low-pressure casing and tubing heads feature low cost and maximum parts interchangeability.

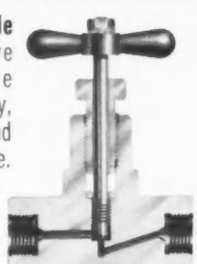


C-22 Casing Head — A straight-bore casing head designed to support maximum loads and to accept any of three interchangeable hangers.

Type M Tubing Heads — These macaroni tubing heads are designed for hanging 1½-inch and smaller inner tubing strings, especially for tubingless completions. They can be supplied with either flanged or threaded connections.



15,000 psi Needle Valve — This valve has a one-piece forged steel body, Teflon packing, and stainless-steel needle.



Heater Choke — O•C•T's heater choke is designed to give you extra nose length in the heater fluid; acme-thread unions speed installation and removal; many parts are interchangeable with other O•C•T chokes.

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FMC CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas

where progress is a daily practice

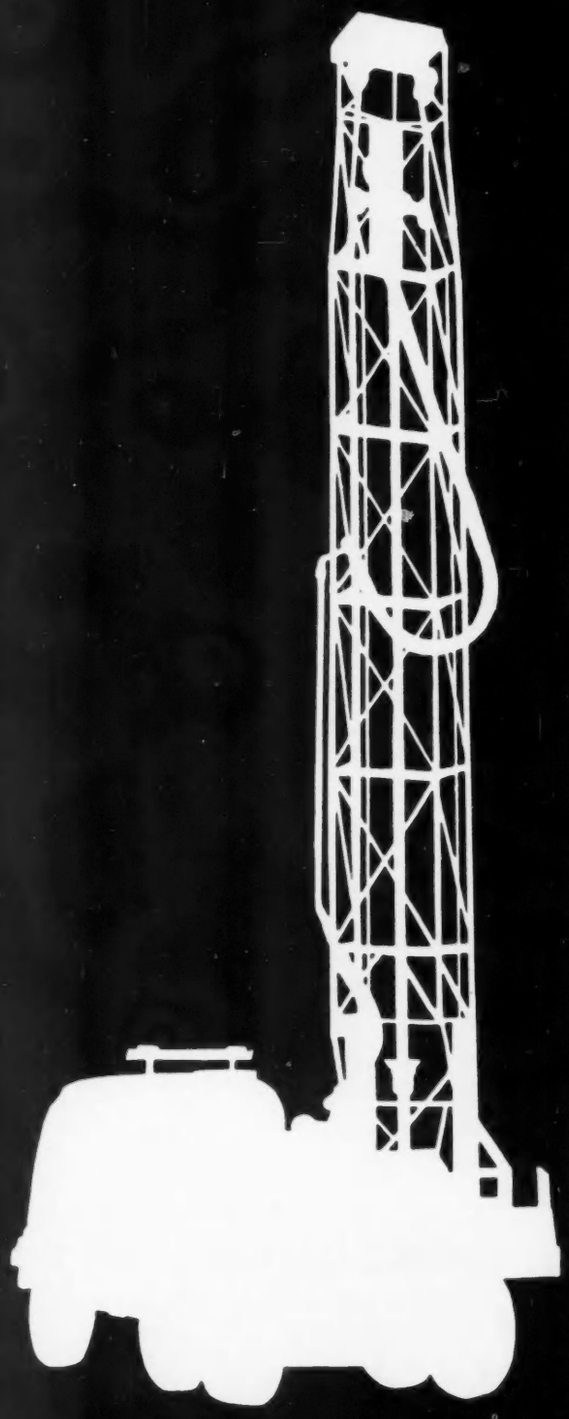
Going Great Guns in Houston. The majors have taken over on all fronts: Baseball operations with the Colt .45's, Houston's new National League Baseball team. Oil, with the domiciling here of domestic operations for many major oil companies. The result is that more and more interested companies are setting up a watching post here for the one and a listening post for the other. As the principal business bank in Houston, The Bank of Commerce can help you with contacts, advice, and, of course, all bank services including an **experienced** Oil and Gas Department.

your new direction GO

THE NATIONAL
BANK OF COMMERCE
OF HOUSTON

MAIN, TRAVIS AND CAPITOL

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION



It's a pleasure to do business via BOAC.

Wherever your commercial travels take you, it's a pleasure to jet there via BOAC. BOAC's coverage includes 52 countries on all 6 continents. The world's present and potential oil producing areas are virtually daily destinations of BOAC and its associate carriers. Jet flights to Abadan, Kuwait, Trinidad, Caracas, Tripoli and Benghazi, for example.

BOAC's famed British Cabin Service is a flight experience that makes getting there a constant pleasure. You are very well attended.

Flights from New York, Boston, Chicago, Detroit, Honolulu, Los Angeles, San Francisco, Washington/Baltimore; Montreal, Toronto.

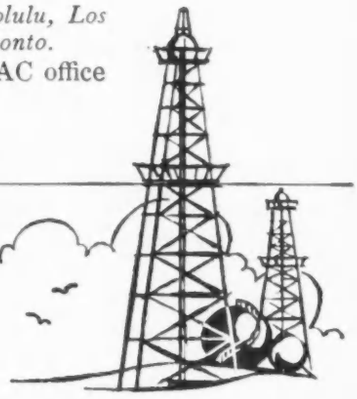
Your Travel Agent, Travel Department or any BOAC office will be happy to mix your business with pleasure.

B·O·A·C

World Leader in Jet Travel

BRITISH OVERSEAS AIRWAYS CORPORATION

Offices in all major cities



Oil-men all over the world prefer SAG-buildings

Their outstanding advantages: short delivery periods
quick and easy erection and dismantling
protection against fire and insects
suitable for all climatic zones
protection against corrosion by hot-dip galvanizing, therefore lowest maintenance cost.

Our experts will help to solve your problems. Technical advice and documentation without any obligation, by

SIEGENER AG · GEISWEID

Western Germany · **Geisweid Kr. Siegen** · **Telephone: 7141 · Telex: 08 78 29**

Target

Economy • Service • Safety

There's no danger of over-buying when you specify W. C. Norris Well Head Equipment, for the Norris line is a complete line . . . with a wide range of tubing and casing heads engineered to meet your actual needs. Norris heads offer you high selectivity . . . true economy . . . without sacrificing design, service or safety. You can buy with confidence when you buy Norris. Write for prices and complete literature today!

BUY FROM YOUR NORRIS DISTRIBUTOR

NORRIS HINDERLITER
WELL HEAD EQUIPMENT

W. C. NORRIS DIVISION
DOVER CORPORATION
P. O. BOX 1739 • TULSA, OKLA.

BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

Nothing less than Autocar satisfies oil-field service men. They know that however tough the going, Autocar walks through it.

"Oil-field service is tough . . . BUT AUTOCAR'S TOUGHER!"

Toughness—and the ability to take it under *all* conditions—is what Autocar brings to oil-patch service, and what makes oilmen say, "Anything *less* than an Autocar in our work doesn't last long."

Autocars get there in a hurry . . . over the roughest terrain, day and night, without fail. Pipe, rigs, cement, chemicals or what-have-you, are all taken in stride.

Each Autocar is custom-engineered to meet the specific conditions of the job. And each has the quality, the performance and the stamina you need for the toughest jobs.

Your service is one where time is most important. Why should you settle for less than the "World's Finest"? White-Autocar comprehensive service throughout the U.S.A.

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

For both contractor and company, the blue ink on a *complete* Drilling Recorder chart helps put more "black" ink on the books. Today's competitive conditions demand maximum efficiency, in drilling, in supervision, in analyzing structures drilled.

On a single chart, Totco's 3-pen Drilling Recorder gives accurate, directly comparable data for penetration, weight in suspension, and torque or pump pressure. *Only Totco* "tells the hole story" so clearly, accurately and completely... minute by minute... foot by foot.

IN USE ON OVER 300 DRILLING RIGS

In over two years of field service, the Totco Drilling Recorder has been thoroughly proved. On the Totco chart *every movement of the brake*...every change in weight is recorded permitting a detailed analysis of the time required for *every* operation. You can see weight on bottom at a glance. A torque record pinpoints tight spots or locked cones giving you a warning of possible trouble. Or, in lieu of torque, pump pressure may be recorded.

One driller, for example, noted on his chart that pump pressure gradually was dropping though pump operation had not changed. He pulled the string, found a hole in the pipe that soon would have caused a twist-off, saved anywhere from one to fifty thousand dollars in fishing costs.*

Totco Drilling Recorders are available throughout most of the United States and Canada on daily rental or term lease. Sold outright for export. Get complete data; write for Technical Bulletin.

*An actual case. Details on request.

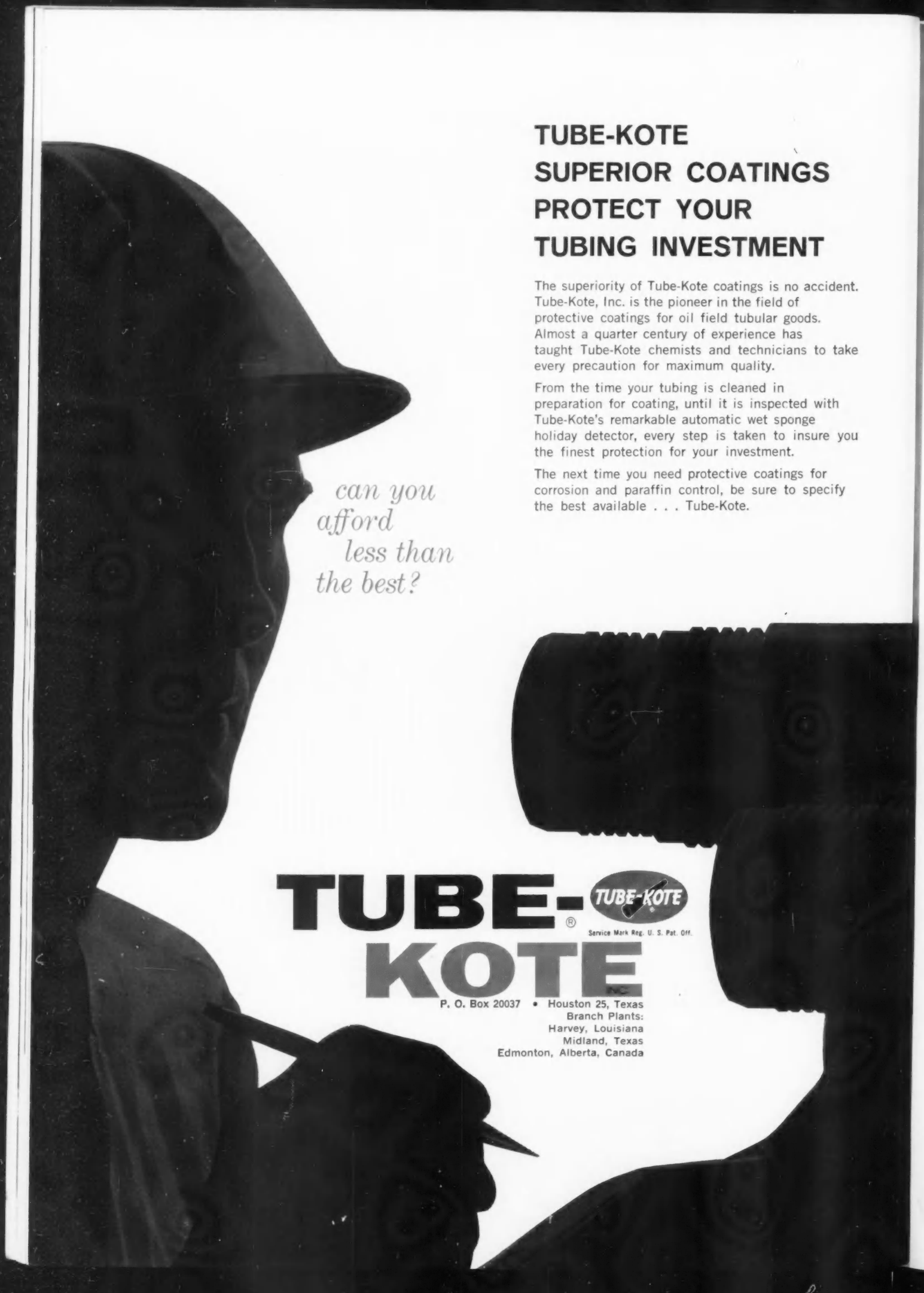
CHART YOUR WAY TO INCREASED PROFITS

TOTCO

DRILLING RECORDER

TECHNICAL OIL TOOL CORPORATION
1057 No. La Brea Avenue, Los Angeles 38, Calif. • OLdfield 4-1763
Manufacturers of Precision Instruments since 1929

EXCLUSIVE DISTRIBUTORS:
California: The Republic Supply Co. of California – *Domestic:* The Continental-Emsco Company, a division of Youngstown Sheet & Tube Company – *Canada:* Oil Well Supply Division, United States Steel Corporation – *Export:* Lucey Export Corp., New York City



TUBE-KOTE SUPERIOR COATINGS PROTECT YOUR TUBING INVESTMENT

The superiority of Tube-Kote coatings is no accident. Tube-Kote, Inc. is the pioneer in the field of protective coatings for oil field tubular goods. Almost a quarter century of experience has taught Tube-Kote chemists and technicians to take every precaution for maximum quality.

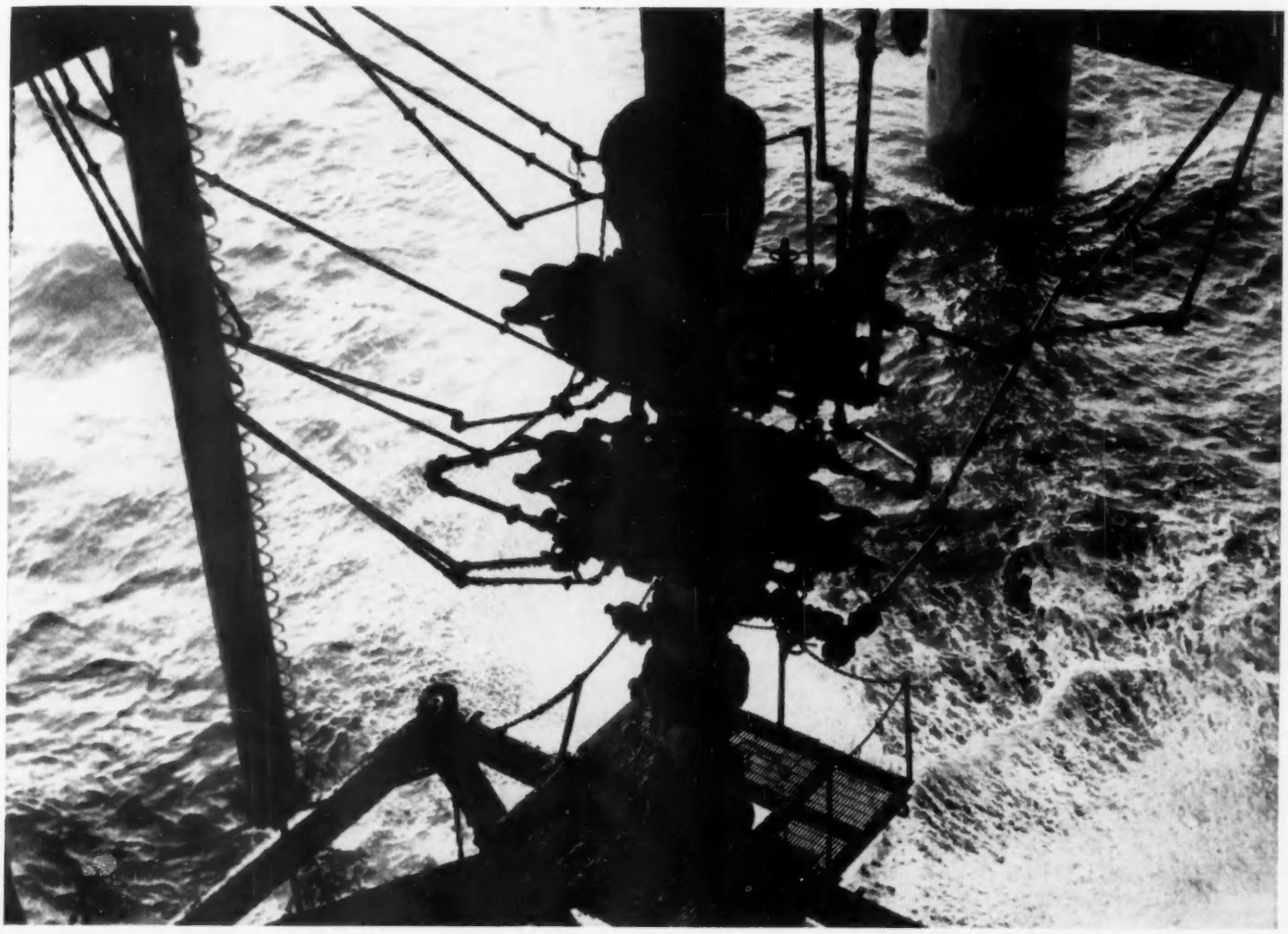
From the time your tubing is cleaned in preparation for coating, until it is inspected with Tube-Kote's remarkable automatic wet sponge holiday detector, every step is taken to insure you the finest protection for your investment.

The next time you need protective coatings for corrosion and paraffin control, be sure to specify the best available . . . Tube-Kote.

TUBE-KOTE®

Service Mark Reg. U. S. Pat. Off.

P. O. Box 20037 • Houston 25, Texas
Branch Plants:
Harvey, Louisiana
Midland, Texas
Edmonton, Alberta, Canada

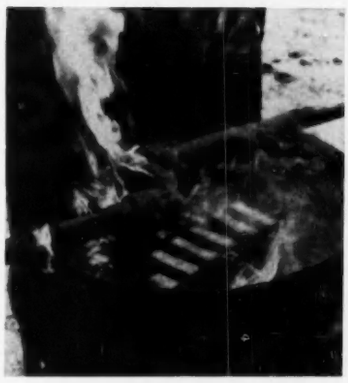


CHIKSAN joints make metal lines

flexible...

safer and easier to hookup

CHIKSAN ball bearing swivel joints are tried and trusted in every oil field. They give blowout preventer control lines complete flexibility. This flexibility makes line hookup easier and faster; overcomes blowout preventer line stress fatigue. Flexible lines can be folded into compact units for moving. CHIKSAN swivel joints are known throughout the oil world for long service life, low maintenance and unequaled safety factor. Available from your nearest supply store.



FLAME TESTED!

To determine their ability to sustain pressure long enough for functioning of blowout preventer equipment, CHIKSAN swivel joints were subjected to a severe flame test. With inflammable hydraulic fluid in the line, under 1800 psi line pressure, open flame was applied to the CHIKSAN swivel joints reaching temperatures up to 650°F. The CHIKSAN swivel joints performed satisfactorily for 60 minutes under these extreme conditions. This is about 55 minutes longer than the time needed for operation of the blowout preventer.

fmc CORPORATION ® **BREA, CALIFORNIA, U.S.A.** **CHIKSAN**

A subsidiary of FMC Corporation • Well Equipment Mfg. Corp. Division (Weco Unions, Hamer Valves) • Chiksan International • Chiksan of Canada Ltd. • Offices and Representatives in Principal Cities of the World

FROM oilmaster

An Insert Pump Anchor That:

1. **Sets, Packs-off and Releases Without Rotation!**
2. **Eliminates Risk of Unscrewing Rods!**
3. **Permits Raising, Lowering or Re-Setting Pump Without Pulling Tubing!**

Here's a combination pump anchor and pack-off that is the ideal solution for wells where a shoe or seating nipple has not been provided for the pump. It's the Oilmaster Insert Pump Anchor—a *vertical setting* pump anchor that requires no rod rotation (either forward or backward) to set, release, pack-off or re-position the anchor in the well.

New! Advanced type of collet design maintains pack-off without wicker devices. It's simple, positive, trouble-free!

- **There's no risk of unscrewing the rod string while installing or releasing the Oilmaster Anchor.**
- **The Oilmaster Anchor can readily be set in crooked or directionally-drilled wells.**
- **No clutch arrangement is required on the pump.**
- **The Oilmaster's compression pack-off provides a positive seal, even in worn, pitted or "ring-wormed" tubing.**
- **The Oilmaster Anchor can be set, released and re-set without damaging the packing element. No shear pins are used!**
- **The Oilmaster Anchor provides a positive hold-down, even should the well flow through the pump.**

Complete Control with Unique VERTICAL Action!

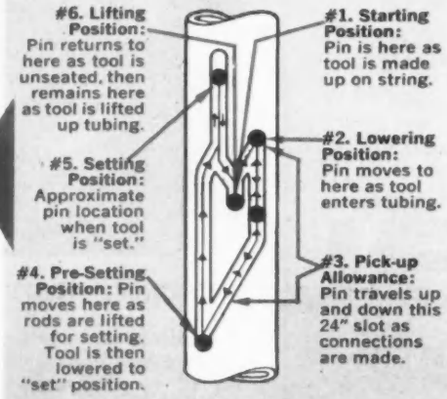

#6. Lifting Position: Pin returns to here as tool is unseated, then remains here as tool is lifted up tubing.
#5. Setting Position: Approximate pin location when tool is "set."
#4. Pre-Setting Position: Pin moves here as rods are lifted for setting. Tool is then lowered to "set" position.
#1. Starting Position: Pin is here as tool is made up on string.
#2. Lowering Position: Pin moves to here as tool enters tubing.
#3. Pick-up Allowance: Pin travels up and down this 24" slot as connections are made.

DIAGRAM-KNOWLTON PATENTED SETTING SLOT—MFG. UNDER LICENSE FROM KNOWLTON OIL TOOL CO.

COMPARE the above advantages against the pump anchors you are now using. Why jeopardize your wells with anything *less* than the Oilmaster Insert Pump Anchor?

Want More Facts?

Ask for Bulletin 6104 which gives details, cutaway views and operating data. No obligation of course!

DISTRIBUTED BY: Beacon Supply Company • Dominion Oilfields Supply Company, Limited • Industrial Supply Company • National Supply Division, Armco Steel Corporation • Union Supply Company

ARMCO Fluid Packed Pump

This Bethlehem Rotary Drilling Line is on its seventh well —

and is still in good shape!

Natural Gas Drilling Co., Inc., is a well-organized outfit whose operations involve a lot of moving about. For example, this rig drills an average of 3,000 to 4,000 feet per well. And drilling time at each location is from 7 to 10 days—including rig-up and rig-down time.

That's why a sturdy, long-lasting rotary line is so important. It must be able to survive the rigors of moving, yet be able to go right to work on arrival. The 1-in. Bethlehem Purple Strand wire rope on this unit has already drilled six wells and is still in excellent condition. It is expected to log a lot more ton-miles.

By using long lengths of rotary drilling line and a controlled cut-off program recommended by Bethlehem, Natural Gas Drilling Co., Inc., finds they now drill more wells at a lower cost per ton-mile.

Why not phone your nearest Bethlehem Sales office for the advice of a wire rope expert? Find out how a planned cut-off program can save money for you.

Steel

for Strength
... Economy
... Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL
BETHLEHEM WIRE ROPE

WORKOVERS UNDER PRESSURE

Brown Hydraulic Snubber Workover Units are so compact, easy to rig up, easy to operate and safe that they are kept busy working over wells without killing them. Tubing is pulled and rerun without any danger of damaging the reservoir by fluids such as salt water or mud. Operators save the cost of mud and time required to kill the well and to bring it back in after the workover.

In addition to planned workovers, emergency work such as recovering parted tubing, washing over stuck pipe, washing out sand bridges, fishing jobs and many other operations can be performed smoothly and under complete control with the Brown Hydraulic Snubber Workover Unit. Its compactness and portability are especially valuable at offshore platforms and inaccessible wells. All operations are controlled from the console which may be adjacent to the well or more remote as desired.

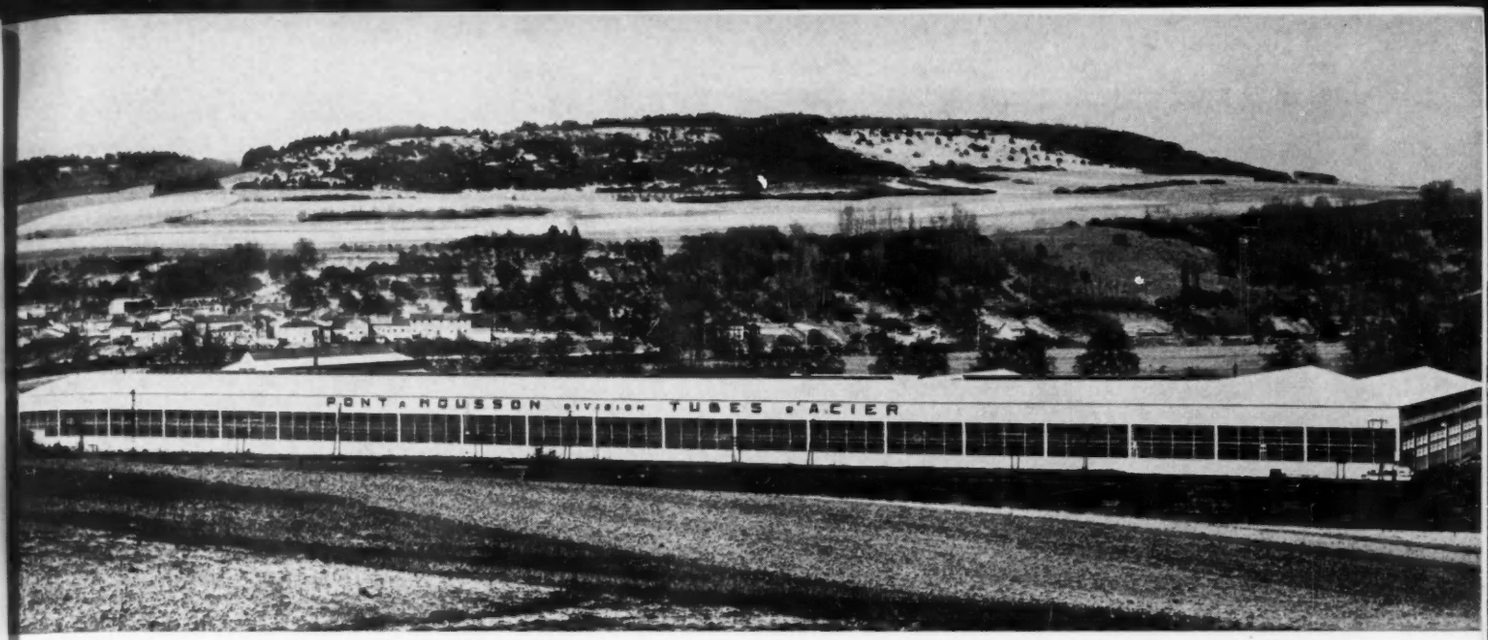
Ask for the new brochure on the Brown Hydraulic Snubber Workover Unit.

BOT

BROWN

OIL TOOLS, INC.

8490 KATY ROAD P. O. BOX 19236,
HOUSTON 24, TEXAS



General panorama of the Belleville mill of Pont-à-Mousson.

"FRENCH STEEL PIPE INDUSTRY *EXPANDS AS NORTH AFRICAN CRISIS SPEEDS GROWTH"*

The booming French steel pipe industry, already taking giant strides as the Sahara yields new oil potential, got new impetus as a result of the recent tension in Tunisia.

Following the outbreak of violence in Bizerte in July, the Tunisian government cut the oil flow from Edjeleh. In response, French petroleum interests decided immediately to construct a new pipe line connecting the C.R.E.P.S. eastern Sahara fields with the existing pipe lines that run through Ohanet and Hassi-Messaoud, and thence to the Mediterranean.

The project had been on the drawing board, but scheduled for the indefinite future. The Tunisian flare-up, within the span of a few hours, brought the decision to get the work under way without delay.

Urgent orders were placed in early September with the Belleville Plant of the Société des Fonderies de Pont-à-Mousson, a major French pipe and tube manufacturer which had supplied pipe for the eastern European pipeline complex "Lavera-Strasbourg."

The firm's production team were asked if the short delivery dates for the huge order could be met. Back came the response: "Can do!" This confident answer is typical of the production power and resources of the steadily growing French steel pipe industry. For example, the Belleville plant which makes welded pipe is but one division of the Société des Fonderies de Pont-à-Mousson. Internationally known, Pont-à-Mousson is a major holding Company with extensive interests in coal mining, steel mill and pipe founderies, in addition directs pipe-laying and construction companies in 15 other countries. Its specialization in steel pipe and tube manufacture and construction has won it a special international recognition as a major supplier of facilities for volume transport of petroleum and gas by pipeline.

In the Common Market, Pont-à-Mousson controls the HADIR Company which manufactures small diameter welded pipes in Luxembourg; in Germany, the Halberghütte Company for oil pumps and compressors; in France and in the oil and gas fields, PONT-A-MOUSSON directs—through its subsidiary SIDELOR—the seamless steel-pipe plant at Déville-les-Rouen, the most modern mill in Europe. This plant manufactures all sizes of seamless steel pipes from ⅓" to 10¾" in all grades of steel recognized by the American Petroleum Institute. Ductile iron pipes, used by a majority of French Tanker fleet, were first manufactured in Europe by the PONT-A-MOUSSON complex. In welded pipe the production line at the Société des Fonderies in Belleville provides tubes from 16" to 42", generally in X52 steel, and also in other grades of steel if necessary.

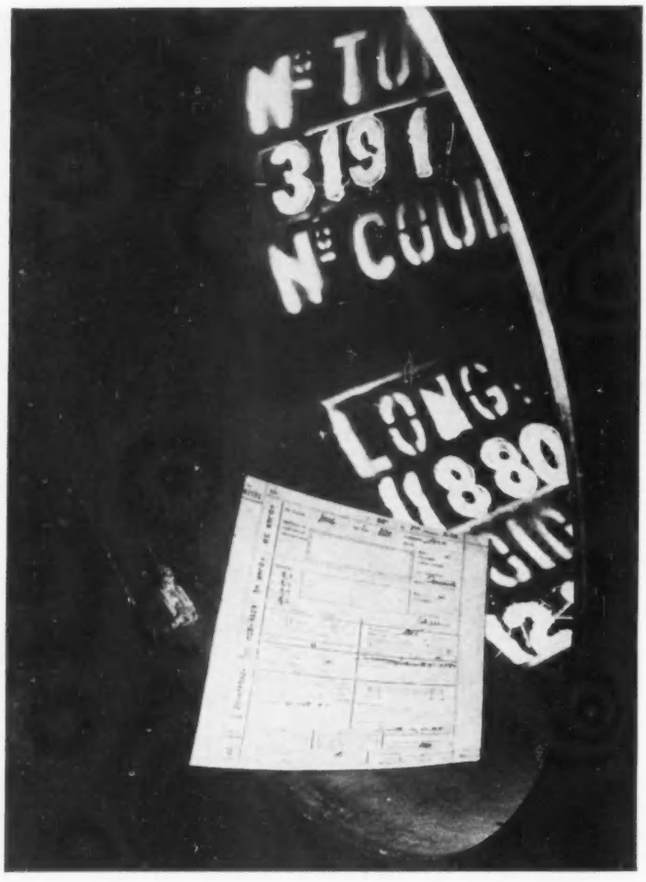
Belleville additionally finds itself working with many special orders. For example, boiler pipes with diameters up to ten feet.

The plant at Déville-les-Rouen for seamless steel pipes is modelled after American prototypes. However, the Belleville mill follows the successful patterns established in other Pont-à-Mousson plants in Europe.

The plant's modern Research Center guided the selection of the special steel for the cross-Mediterranean pipeline. A major pipe-laying Company of the Group: EAU et ASSAINISSEMENT-SOCOMAN is closely studying applications in this particular field.

Of necessity, much production equipment on the pipe production line at Belleville is originally designed. It

(Advertisement)



Précise quality control by the specific identity card which follows each tube through the production line and on which is noted specifications and control test data.

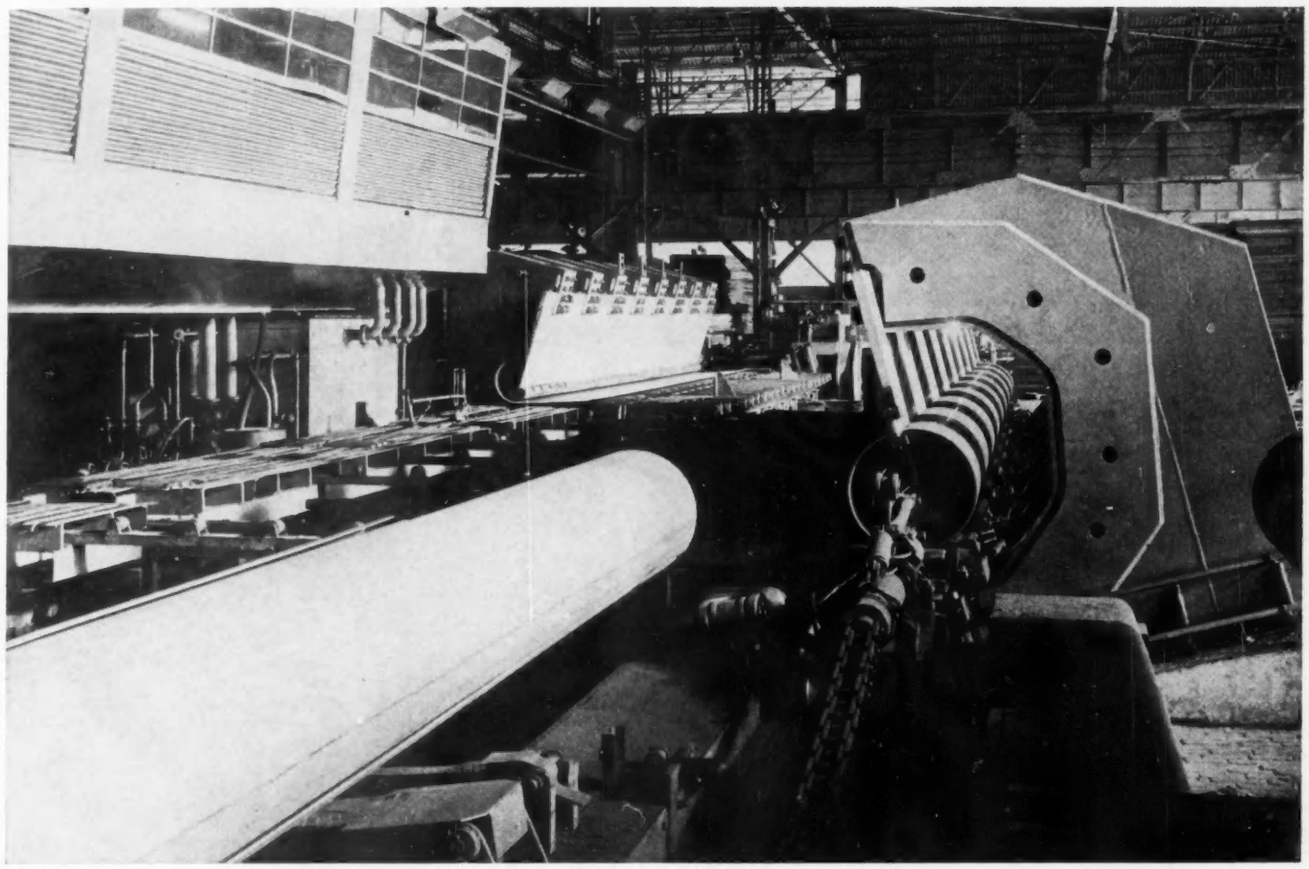
employs a high degree of automation and the long steel plates are folded, curved into a "C" shape then pressed in the final "O" before welding with remarkable facility. The inner welding is controlled on a TV screen filmed by the camera's lens at the welding head. Outside welding is done under the guidance of a light signal, also with automatic ease. Both ends of the tube are then cut with a blow torch and then hydraulically expanded into final shape. The final operation—end facing and bevelling—follows and a pipe is born.

The plant is equipped to provide the various protective coating processes, inner and outside, to customer specifications. Unusual mechanical and boiler shaping equipment are also part of the plant's facilities. Rigid inspections afford good quality control, and out of one 60-employee shift, as example, 18 persons are engaged in quality control operations. Inspectors wear green uniforms to distinguish them from the production men wearing blue. Total output of this one 60-man crew per shift is roughly one mile of steel tubes. Each control point finds several inspectors who select tubes at random from each run of 50 tubes. These samples undergo a rigorous pattern of tests designed to confirm tensile strength, welding efficiency and the stress placed on the metal by the folding and bending operations. These tubes are of course deleted from the production run, but serve their purpose in affording a constant spot check of the production run.

On reaching the inspection shop, the steel plate is subjected to a wide range of tests: ultrasonic, various and special measurements. The tube is identified, marked and then gets its "identification card" which stays with it right up to finishing point.

New testing methods utilizing advanced ultra-sonic techniques are applied for the second time to welding points prior to final X-Ray control.

(Advertisement)



Automation guides the shaping and bending of flat steel plates into circular tubes ready to weld. The "C" shaping operation (center rear) precedes the final "O" shaping operation at the right (ϕ 16 to 42").

Following the welding operation, the tube again undergoes ultra-sonic examination. Even slight faults call for an X-Ray and eventual return for semi-automatic repair. The final test during production is hydrostatic pressure control, following expansion of the tubes according to A.P.I. specifications.

M. PIERSON, Plant Alternate Manager states that "It is barely possible that a defective tube might leave our plant but hardly probable."

Even after the tube is finished, another series of inspection operations begins: the ultra-sonic welding test, using still more sensitive testing equipment, then systematic X-Rays for *all* tubes and, finally, special testing of doubtful spots disclosed during ultra-sonic tests. Dimensional inspection also takes place before delivery of the tube.

"As a matter of fact, the Official A.P.I. certificate which hangs in my office is a continuing challenge to us not only to meet the basic approved A.P.I. standards, but also to surpass them in many cases."

These strict control standards have paid off, and have won the respect of foreign competitors. "American or Russian Technicians who visited our plant have been greatly impressed by the extent and quality of our controls" adds Plant Manager, Monsieur SOGNET.

Mr. CLEMENTZ, Head of the SOCIETE des FONDERIES de PONT-A-MOUSSON said also: "We try to keep inspection measures at peak efficiency. Perhaps as a result our tubes are found on all lines constructed in the Sahara and in France since 1957, when our production first started. Also, and this is equally important, we keep our prices competitive.

"As an important link in the chain of Companies involved in pipe work production under the PONT-A-MOUSSON Label, the welded pipe plant at Belleville should play a major role in the petroleum and gas industry. Indeed we are awaiting a considerable expansion of pipe transportation especially in the oil, gas and raw and finished product categories."

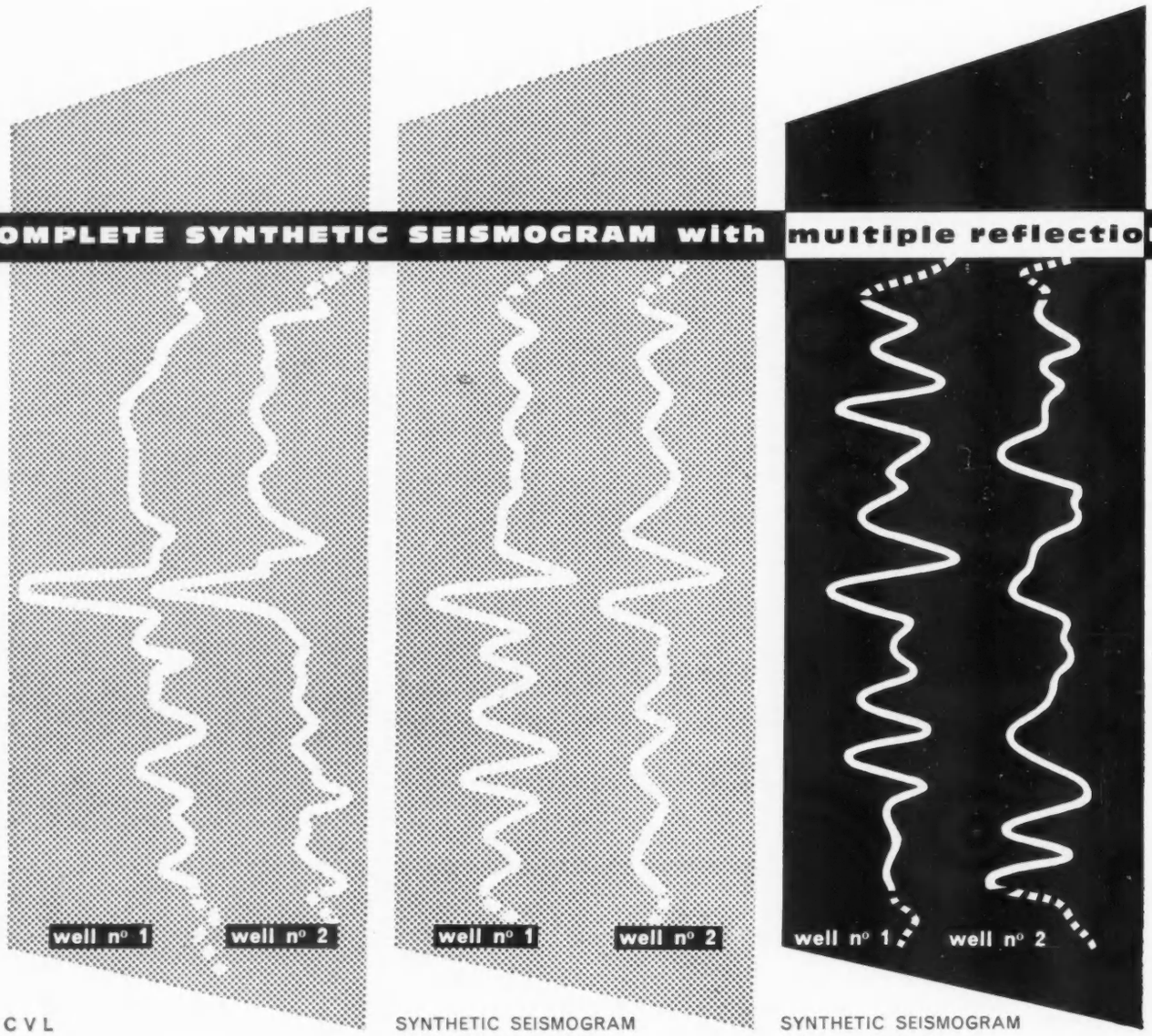
PONT-A-MOUSSON

MAIN OFFICES

PARIS 24, rue de Prony (17e) — NEW YORK Pontex Pipe Corp. 116 John Street, Suite 1317, New York 38, N. Y.
SAO PAULO Rua Marconi 131 (7e andar) — MEXICO DF Apartado 1014 Monterrey 29 —
BUENOS AIRES Calle Peru 263, 7e Piso — BEYROUTH P. O. B. 3359 — BANGKOK P. O. B. 280

A NEW METHOD OF IMPROVING THE PRESENTATION AND THE INTERPRETATION OF SEISMIC RECORDS

THE COMPLETE SYNTHETIC SEISMOGRAM with multiple reflections



C V L

SYNTHETIC SEISMOGRAM WITHOUT MULTIPLES

SYNTHETIC SEISMOGRAM WITH MULTIPLES

What geological and geophysical information can be obtained after synthetic seismograms are examined and are compared with the actual records ?

The synthetic seismograms make it possible to ascertain the existence and the quality of the horizons which may be used as good markers

The synthetic seismogram leads to improvements of the field techniques: automatic gain control and filtering

The synthetic seismograms are conducive to a more complete and more acurate interpretation

Using the synthetic seismogram your past and present surveys can attain their full value

The cost of a synthetic seismogram with multiple reflections varies with the depth logged : 20 to 25 % of the cost of the logging operations proper

For a borehole of average depth, this cost is no higher than that of one kilometer of seismic profile

YOU TOO WILL BENEFIT FROM THE USE OF THIS NEW GEOPHYSICAL TOOL

COMPAGNIE GÉNÉRALE DE GÉOPHYSIQUE

50, rue Fabert - Paris 7e - Phone : Invalides 46-24

G and H
Offshore
FLEET
If it floats,
G&H Offshore
Can Tow It... Anytime
Specialists in Gulf Coast tidelands and deep sea towing. All assignments handled with speed, safety, efficiency and economy.
With diversified marine experience, G & H Offshore operates a modern fleet of diesel tugboats. Seasoned, licensed seamen are working partners in your offshore tow.
Call us today and let us help you plan your next towing job.
DISPATCHER DAY OR NIGHT PHONE Galveston SO 3-4673
Galveston Office SO 3-4331
G & H OFFSHORE TOWING CO., INC.
COASTWISE AND DEEP-SEA TOWING
505 U.S. NATIONAL BANK BLDG.
GALVESTON, TEXAS
132

Treatments with T-O Frac have boosted production in many "problem" wells...especially in high-pressure, high-temperature wells where screen-outs are most likely to occur. A gelled fluid, 98 per cent lease crude, kerosene or diesel oil, T-O Frac has many ideal characteristics. It is unaffected by well pressures... is stable to 240° F. It has a high plastic viscosity... a low fluid loss... and the *lowest* friction loss of any BJ fracturing fluid. T-O Frac has superior sand-carrying ability (up to 6 lbs./gal.), reducing the danger of screen-outs to a minimum. These characteristics mean deep, complete penetration into the pay... larger, more-profitable fracture areas. Breaks quickly, too, and is easily removed from the formation after treatment as pipe-line-quality oil.

For complete details, call your local BJ Service field station today.

New! COMPUFRAC electronically computes the best fracturing treatment for your well!

An advanced computer technique, COMPUFRAC solves for fracture areas at various volumes and injection rates for any number of frac fluids—does it in *seconds!* Outputs are based on calculated (not assumed) fracture widths, either vertical or horizontal. You know in advance the optimum volume and injection rate for the fluid best suited to *your* well. COMPUFRAC service available *now* at no extra cost to you. Free Technical Bulletin on request.

BJ SERVICE, INC.

A BORG-WARNER SUBSIDIARY

BJ B-W SERVICE

Long Beach, California • Arlington, Texas • Stations in all major oil fields

WHEN YOU BUY BLOWOUT PREVENTERS

GET SHAFFER "SWING OPEN" DOOR DESIGN... IT SIMPLIFIES RAM CHANGES!

WHAT IT IS: With Shaffer Blowout Preventers each ram is readily accessible by simply unbolting and swinging open a convenient door... a *side*-opening door in the Shaffer Type B and Type E Blowout Preventers—an *end*-opening door in the Shaffer Type XHP and Type LWS Blowout Preventers. Only Shaffer equipment offers this important design advancement!

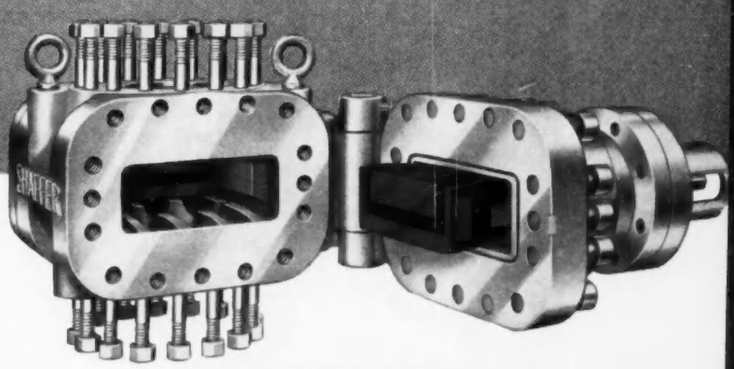
SHAFFER TYPE B AND TYPE E PREVENTERS FEATURE SIDE-OPENING DOORS FOR RAM CHANGES

WHY IT'S BETTER: As a drilling program progresses, it is necessary to change blowout preventer rams whenever the size of the drill pipe is changed. This sounds like a relatively quick and simple operation. And it *is* with Shaffer Blowout Preventers because of their "Swing-Open" door design. But this is not true of *all* blowout preventers...

In blowout preventers that do not have quick-access doors, changing the rams—or checking the ram compartments—can be a complicated, time-consuming operation. In many cases, a major portion of the control gate assembly must be dismantled in order to gain access to the ram compartments—particularly those in the lower unit of a two unit hook-up.

Also with other units, hydraulic lines often must be disconnected, resulting in loss of hydraulic fluid and further complications in the over-all operation—plus the ever-present risk of not properly reconnecting the lines.

But not with Shaffer Blowout Preventers!



SHAFFER TYPE XHP AND TYPE LWS PREVENTERS FEATURE END-OPENING DOORS FOR RAM CHANGES

THE "SWING-OPEN" DOORS IN SHAFFER UNITS

...assure quick, easy access to the ram compartments whenever desired. Moreover, with Shaffer design it is not necessary to break hydraulic lines to open the gates...no fluid is lost... and there's no risk of inadvertently leaving a line "open" (or not properly re-connecting the fittings).

Simply unbolt and swing open the doors. Change rams. Close and bolt the doors shut again. It's that simple!

And the safety and convenience of "Swing-Open" door design is just one of the many "plus" advantages built into *every* Shaffer Blowout Preventer!*

THERE'S A SHAFFER BLOWOUT PREVENTER FOR YOUR PARTICULAR REQUIREMENT!

TYPE B AND TYPE E PREVENTERS are the units selected for most drilling applications. Type B has *non-rising* Locking Shafts for maximum compactness...Type E has *rising* Locking Shafts for quick indication of ram position.

TYPE XHP PREVENTERS are ideal where extra-high well pressures are a problem. Each XHP unit is individually tested to 15,000 PSI Working Pressure in 7 1/16" Bore Size...to 10,000 PSI Working Pressure in 9" and 11" Bore Sizes.

TYPE LWS PREVENTERS combine lightweight with adequate pressure rating for a wide range of applications. LWS units weigh approximately *half* as much as other Preventers of comparable size!

The above Preventers (except Type XHP) are available in choice of Double units (*two* Preventers unitized into *one* compact body for maximum space-saving)—or Single units.

See your nearest Shaffer representative for complete details. Or write direct!

*OTHER SALIENT SHAFFER ADVANTAGES...

- Positive "In-Line" Power Drive!
- Space-Saving Compactness!
- Self-Cleaning Ram Compartments!
- Completely Enclosed Construction!
- "Floating" Ram Design!

...and still others your Shaffer representative will gladly explain to you!

38 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

CALIFORNIA SERVICE SHOPS: Santa Fe Springs, Santa Maria, Ventura, Avenal, Bakersfield and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 1788
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 827
HOUMA, LOUISIANA, Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
EXPORT SALES OFFICE: Shaffer Tool Works, Inc., 5823 103A Street, Edmonton, Alberta.
IN CANADA: Shaffer Western Hemisphere, Inc.

INFLATABLE ELEMENT PACKER SERVICE

- Test-Treat-Test single or multiple zones before running casing
- Selective stimulation in open hole and/or casing
- Formation Fracture impressions
- Water shut-off in air or gas drilled wells
- Treat or test under liners, corroded, patched, uncemented or partially collapsed casing
- Testing patches or liners
- Locating casing leaks, thief zones, water entry or gas-oil contact in casing or open hole
- Cement squeeze in open hole or casing

LYNES INFLATABLE PACKER SERVICE takes the cost inflation out of well testing, treating and zone isolation

Wells can be tested (including stimulation) conclusively before risking expensive casing operations or the possible abandonment of a profitable producer. All possible zones can be tested (using a straddle tool) during one trip into the well

OPERATIONAL FEATURES THAT SAVE YOU MONEY

Sets in open hole and/or casing • Will expand 1.8 times deflated (Run-in) size • Sets by hydraulic pressure — Without weight, slips, drag springs or tail pipe • may be moved and reset under pressure many times during one trip into hole • Greater clearance while running and retrieving

Sealing Elements for use in open hole are 54" long, 26" long for casing use. All elements have friction grip areas to insure positive holding.

LYNES

BRIGHT NAME IN THE OIL PATCH

Inflatable Sealing Element Packers

LYNES, INC.
P. O. Box 12486 • Houston 17, Texas

Single Element Packer
Opens above or below or both

Look to LYNES for the newest ideas, for the best service in the oil fields.

Straddle Packer
Opens above, below, in-between or all three

"Their International Banking Department gives you direct service to every city in the free world. We like the speed and the efficient way they handle our transactions in foreign countries."

Bank of the Southwest
NATIONAL ASSOCIATION, HOUSTON
Member F. D. I. C.

For complete information on our foreign service, write Merle R. Crockard, Vice President and Manager, International Department. It will be a pleasure to serve you through our worldwide network of correspondent banks.

40,000 lbs. of mud pump being loaded on a Mack B61S belonging to B. M. Keller & Co., Inc., trucking contractors of Pampa, Texas. Driver W. W. Mays says "These Macks always get us where we're going and handle like a dream no matter where we take them."

Where more is demanded of a truck

You get more out of a Mack!

Draw works, mud pumps, drill rigs . . . the massive equipment used in oil field work is strictly in the heavyweight class. And when it comes to muscling around this kind of equipment, experienced oil field men know they can do it better with the strength and stamina that Mack trucks bring to the job. No ordinary trucks stand up to the wracking cross country hauls, the tortuous trips to off-highway drill sites, the way a Mack does.

The ability to get through—no matter what the weather or terrain—has made Mack the outstanding choice for tough oil field service. Extra strong frames and chassis take jolt and shock in stride, and the Mack exclusive Balanced Bogie with Power Divider transmits a bias of torque to the wheels with the best traction—gives Mack six-wheelers the ability to tackle the worst kind of going without bogging down.

Contact your nearest Mack Branch or distributor for proof of how a combination of Mack-built components like the exclusive Balanced Bogie with Power Divider can soften up your toughest hauls . . . make bogdowns and breakdowns a thing of the past. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario.

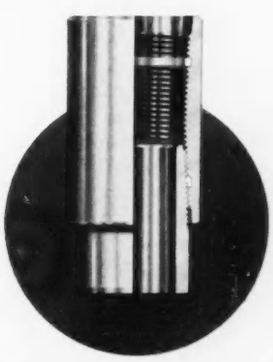
8226

MACK
FIRST NAME FOR
TRUCKS

MACK
for over 8 straight years
NO. 1
by far in sales of diesel trucks

Bucking on Modified Couplings

THESE TWO SEAL RINGS MAKE API COUPLINGS LEAKPROOF



New or Used Casing, Tubing and Line Pipe Couplings Can Be Made Leakproof at Low Cost by ABC

Leaks at couplings are completely eliminated at a very low cost when you use Atlas Bradford's GT-API Modified Couplings*. The Teflon** seals fitted into grooves cut in standard API couplings provide a chemically inert barrier against fluids and gases. Use of these couplings can prevent costly leaks where high pressure and/or shock is a problem.

This patented leakproof advantage can be added to new or used couplings by Atlas Bradford for a nominal cost. Every tubing coupling is given a magnetic particle inspection before modification.

In tubingless or conventional completions, flow lines, wellheads . . . or other applications where leakproof couplings are required, specify the GT-API Modification. Numerous successful installations totaling millions of feet, plus exhaustive laboratory tests have shown the advantages of the Atlas Bradford GT-API Modified Coupling. Write for complete information, or ask your Atlas Bradford representative.

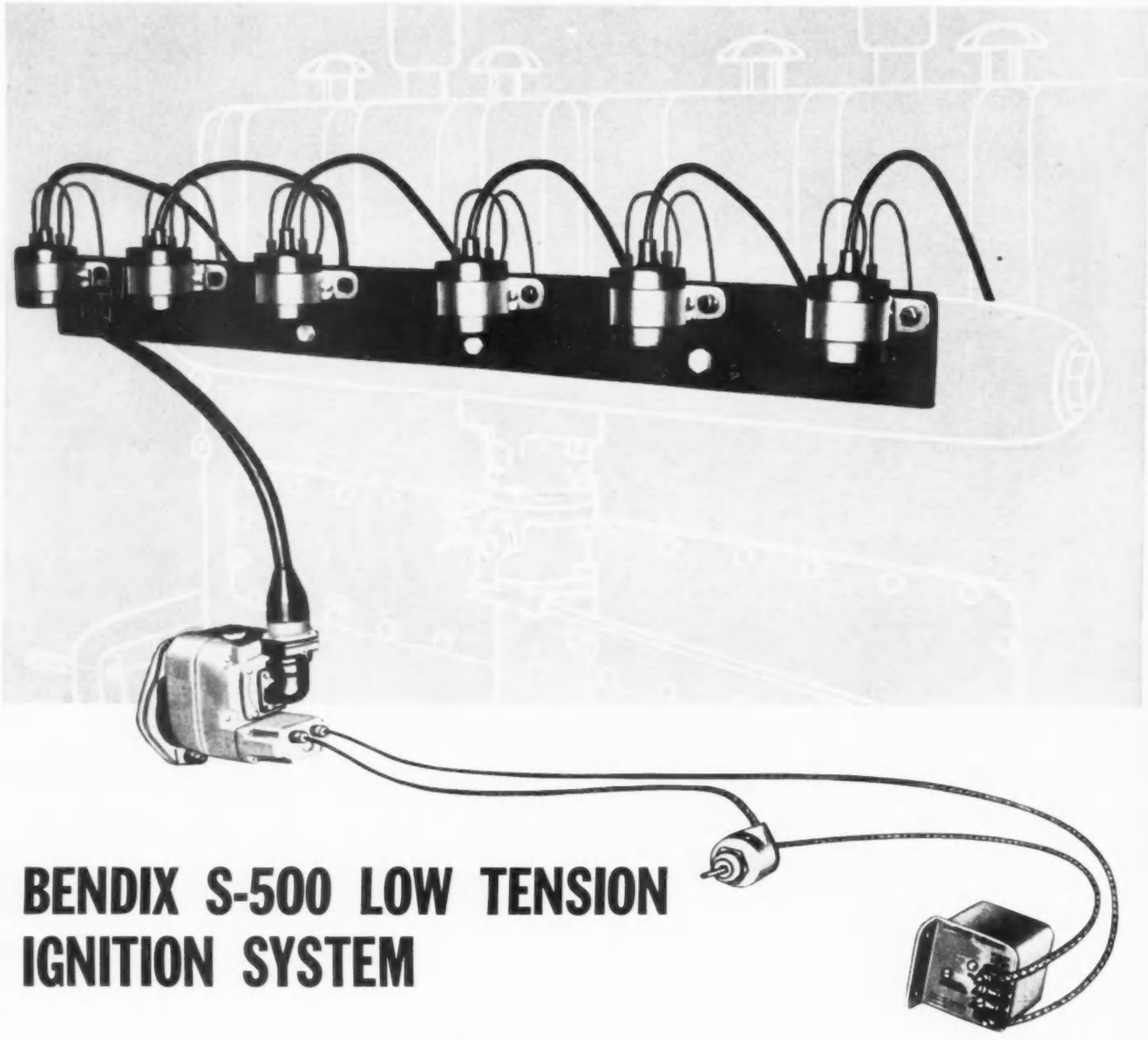
ATLAS BRADFORD COMPANY

General Offices: 3600 Yoakum Blvd., Houston 6, Texas
Export Office: P. O. Box 66669 • Cable: APINC—Houston

Formerly: Atlas Pipe Inc. / Bradford Supply Company / Hardy-Griffin Engineering Corp. / Universal Inspection & Service Co.

*Pat. No. 2,980,451.
**Registered trademark for E. I. Du Pont Co. for their fluorocarbon resins including TFE resins.

The latest for small-to-medium industrial engines



BENDIX S-500 LOW TENSION IGNITION SYSTEM

The S-500 System provides the ultimate in starting and operating efficiency for your four, six, and eight cylinder industrial engines. Specify the new Bendix® S-500 Low Tension Ignition System. It features "the modern starting concept"—retard breaker magneto and starting vibrator system.

This complete Low Tension Ignition System—including transformer coils, wiring cable assembly, starting vibrator, ignition and starting control switch, and retard breaker magneto—is custom-engineered to assure positive ignition at all cranking speeds and varied retard requirements. It is furnished in base or flange mounting, flameproof and radio shielded, is adaptable for manual or automatically controlled installations.

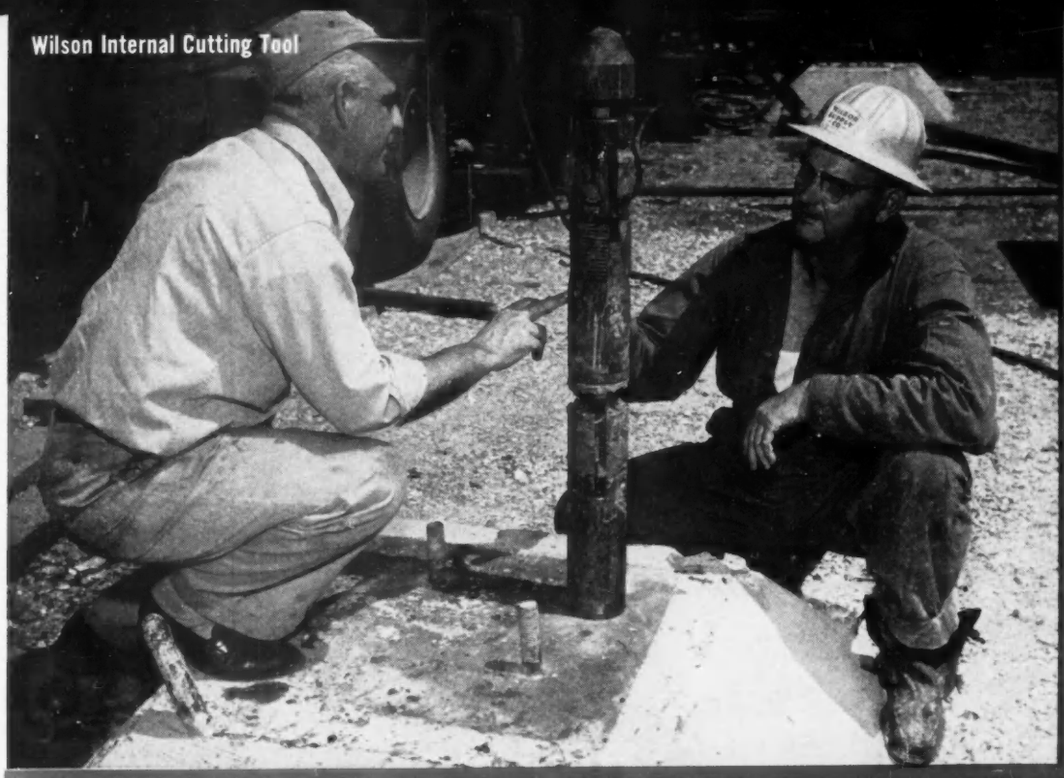
The S-500 Series, either base or flange mounted, is supplied with the following features:

S-500 Standard Shielding, adjustable drive assembly.
S-501 Standard Shielding, adjustable impulse coupling.
S-502 Super-shielded, adjustable drive assembly.
S-503 Super-shielded, adjustable impulse coupling.
S-504 Standard Shielding, retard breaker, adjustable drive.
S-505 Super-shielded, retard breaker, adjustable drive.

For additional information concerning the best Bendix Ignition System for your particular engine requirements, write Bendix International Division, 205 E. 42nd St., New York 17, N.Y., U.S.A. Cable address: "BENDIXINT," N.Y.

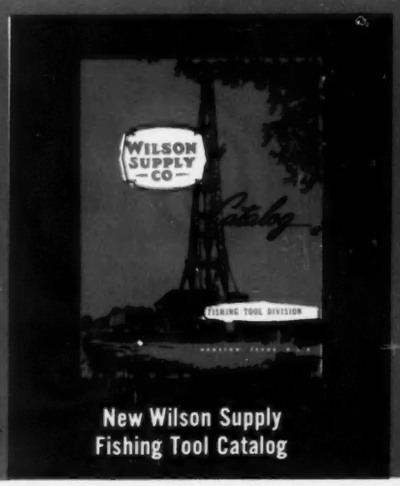
Bendix International Division

THE Bendix CORPORATION

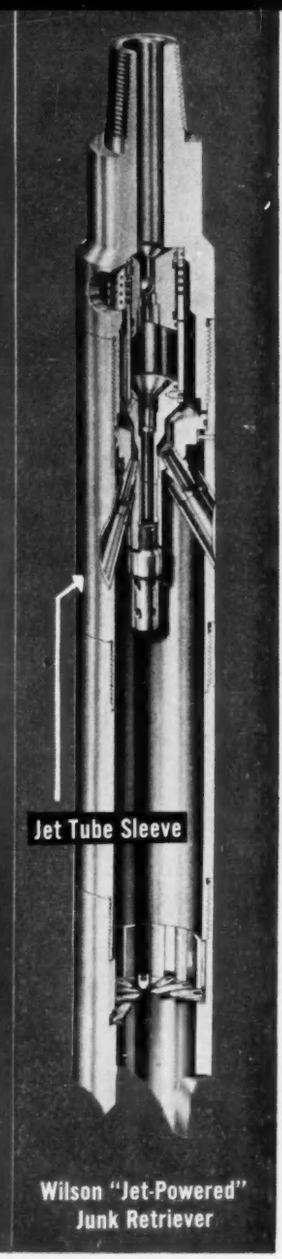


Wilson Internal Cutting Tool

Wilson PS-70 Power Swivel



New Wilson Supply Fishing Tool Catalog



Jet Tube Sleeve

Wilson "Jet-Powered" Junk Retriever

When It Comes to Fishing . . .

Wilson has the Tools and the Men!

The Fishing Tool Division of Wilson Supply has the tools and the operators to save you valuable rig time. The new Wilson PS-70 Power Swivel provides torque up to 4000 ft. lbs. with infinite variations of speed up to 100 RPM under load and in either direction. It is the new, compact trailer mounted hydraulic power swivel, designed for medium drilling operations and well remedial work.

The Wilson "Jet-Powered" Junk Retriever is actually two tools in one! Normally the tool is run with the Jet Tube sleeve in place, making it a true, reverse circulation junk retriever. Remove the Jet Tube sleeve and you have a conventional core-type junk basket. It's the field-proven tool for removing junk, non-ferrous materials and bit cones *FAST*.

And Wilson Supply can provide skilled, veteran operators to handle your fishing job anywhere in the free world. For fishing tool service that is complete, contact Wilson Supply. You'll get the right tools for your job and a skilled operator, too, if you wish.

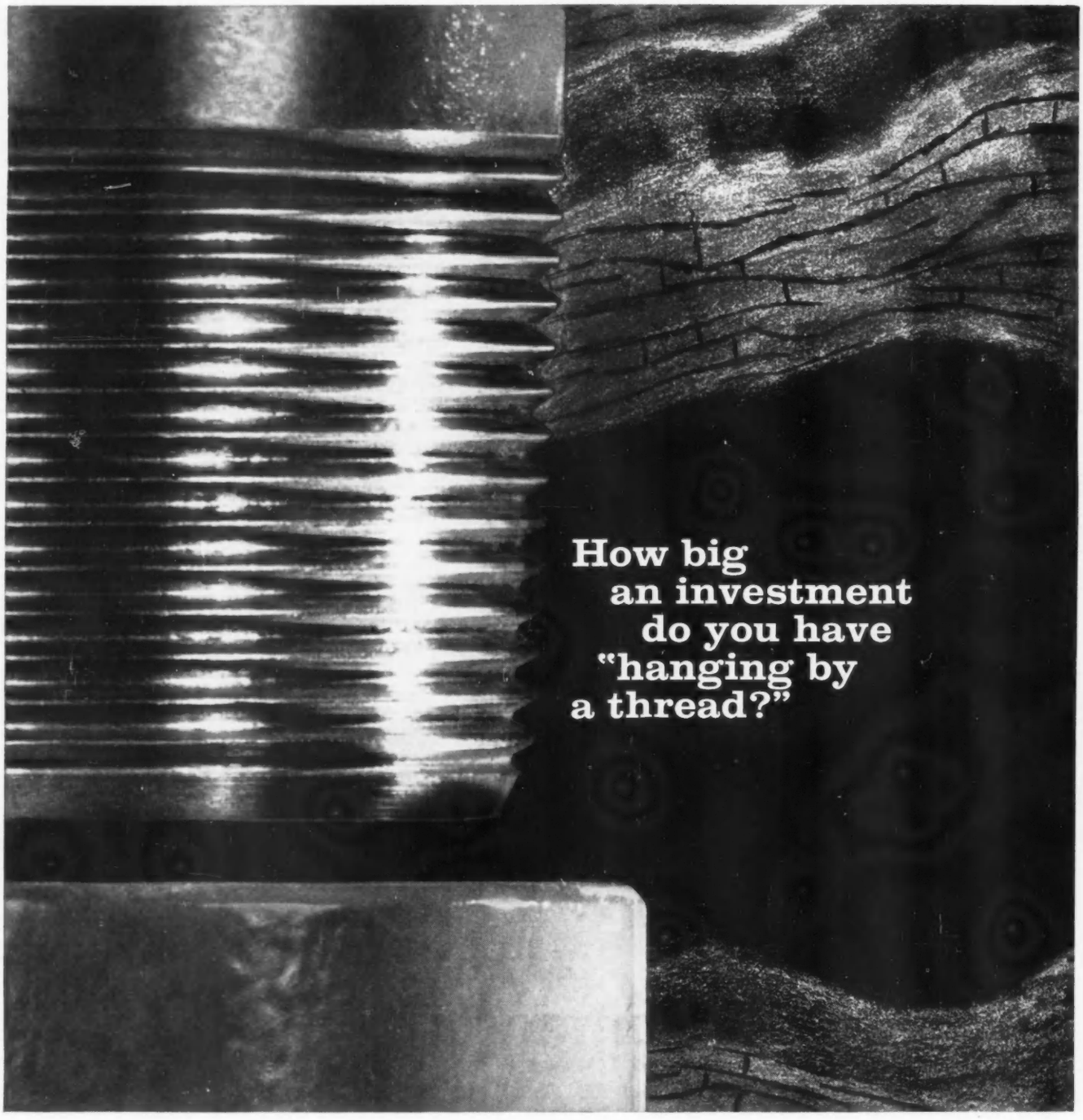
Write for your copy of the new Wilson Supply Fishing Tool Catalog.

WILSON SUPPLY CO
HOUSTON, TEXAS

1301 Conti Street, P. O. Drawer 19, Houston, Texas
International Division
1301 Conti Street, Houston, Texas
9 Rockefeller Plaza, New York 17, N. Y.

Our 40th Year of Service to the Petroleum Industry

Oil & Gas Supplies • Tubular Goods • Production Equipment • Drilling Machinery • Packaged Compressors • Fishing Tools

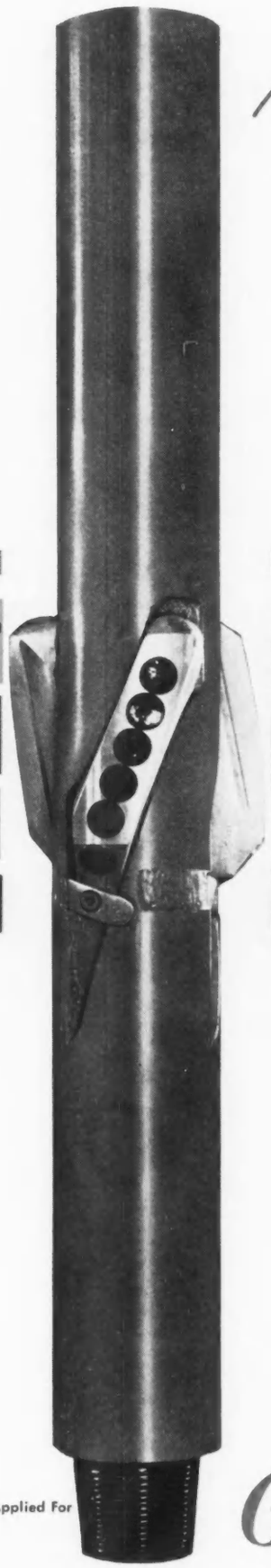


The deeper you go for oil the bigger your investment . . . and the deeper you go the more dependent that investment becomes on the threads that link your casing or tubing into an inseparable unit. That's why the threads for CF&I Seamless Casing and Tubing must pass the most exhaustive of tests—including painstaking checking with a contour microscope. The right lead . . . the right taper . . . the right height . . . the right size—these are some of CF&I's requirements that mean extra strength and pressure-tightness.

Available in sizes 2⅜" through 9⅝" O.D., CF&I Casing and Tubing meets API STD 5A specifications. Your nearby CF&I sales office or distributor has complete details and can provide prompt delivery. 8494

Steel . . . means strength and economy

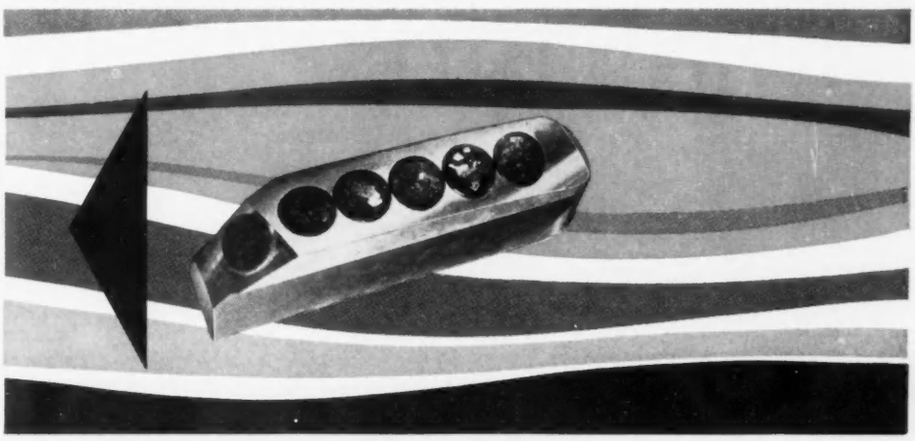
The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales Offices in Key Cities



New Safety... New Economy...

from GRANT in the BUTTON DRILBLADE STABILIZER!

Now—to the *economy* of drill string stabilization with Grant detachable blade stabilizers—you can add *greater safety than ever before.*



Grant's entirely new concept in blade design is this all-new Button Drilblade* of forged and heat-treated aluminum with press-fitted, individually hard-faced, mild steel inserts.
It cannot break off or come loose in the hole.

Longer downhole life of the all-new Button Drilblade is achieved by thicker application of tungsten carbide, made possible by the cupped design of the insert heads. Also, a new type of rod delivers a higher percentage of the hard metal to the bearing surface.

Tensile strength and density of the forged aluminum blade body is further strengthened by the press-fitted steel inserts. Thus, neither the blade nor the inserts can work loose or break off. Yet the blades are easily washed over. Drilblades are retained in the Stabilizer body by tapered slots, engineered so that the blade is actually tightened during use, and by Double-Safety Lock Plates. Removal of Lock Plates permits the blades to be easily changed on the rig floor.

The Grant Drilblade Stabilizer—already the preferred tool for directional drilling all over the world—is now the most dependable tool available for this work.

The new Button Drilblade is fully interchangeable with Grant standard blades. It is available in all body sizes 'round-the-clock from your Grant service man—or write Grant direct for specifications and prices.

*Patent Applied For

GRANT OIL TOOL COMPANY

2042 EAST VERNON AVENUE, LOS ANGELES 58, CALIFORNIA • Cable Address: GRANTOOL

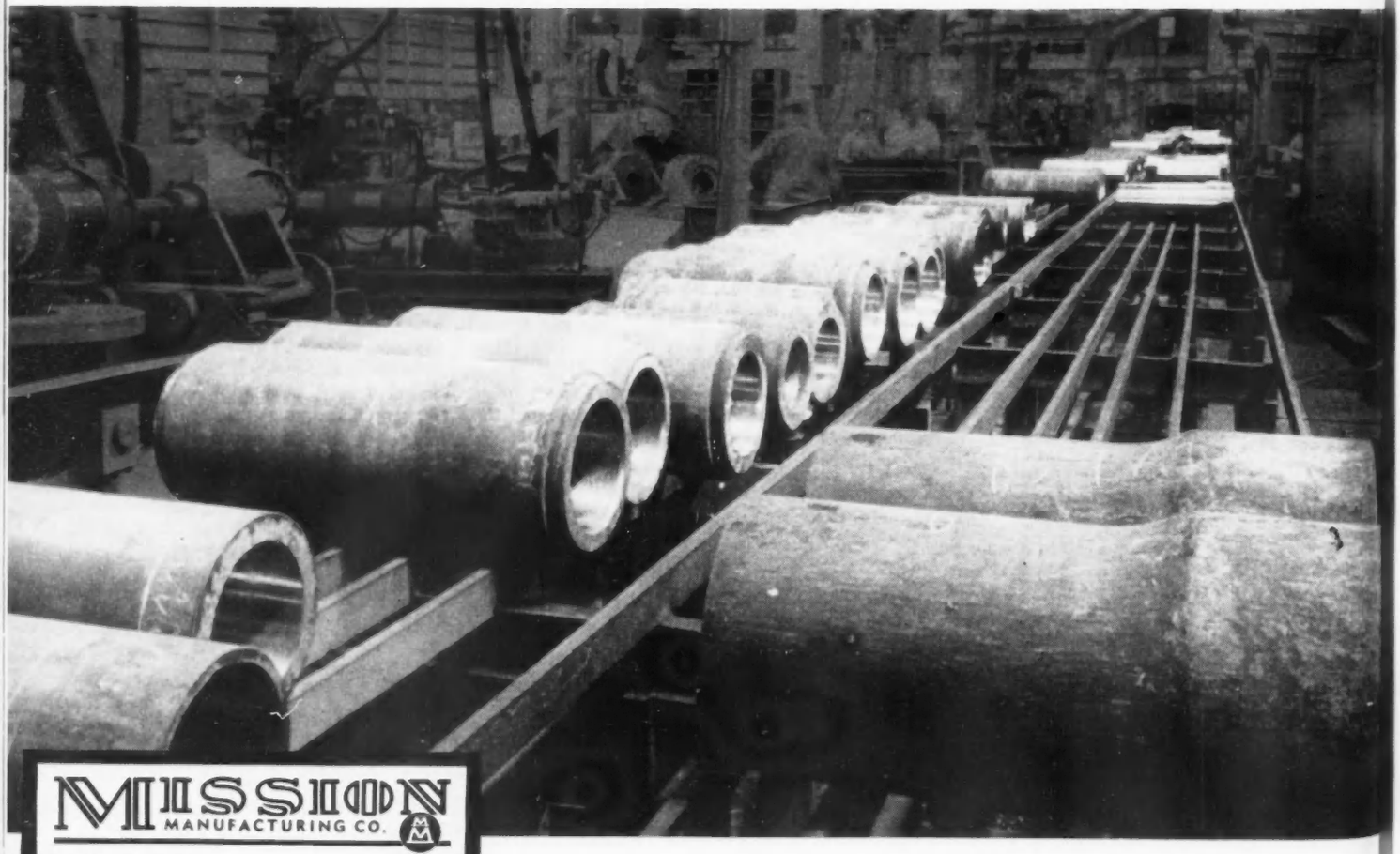
DISTRICT OFFICES AND WAREHOUSES: *Bakersfield, Compton, Ventura, Woodland, Calif. • Liberal, Kan. • Harvey, Houma, Lafayette, La. • Laurel, Miss. • Farmington, Hobbs, N. M. • New York, N. Y. • Ardmore, Oklahoma City, Okla. Corpus Christi, Houston, Kilgore, Odessa, Tex. • Casper, Wyo. • Edmonton, Pincher Creek, Ft. Nelson, Canada*
Representatives in Argentina, Brazil, France, Italy, Middle East, Mexico, Venezuela

the start of long liner life

The reason more Mission Liners are sold than all other makes together is simple: On well after well they have been proved best. Mission quality and superiority don't depend on chance; they are the sum of many carefully attended to details.

Take heat treating, for example. The induction hardening process which Mission uses can be more carefully controlled to a precise depth and hardness. The hardening is uniform, with no soft or thin spots to wear quickly. In tolerances, concentricity of ID and OD, surface finish, hardness, and fit, Mission Liners must meet the most exacting standards. Quality is the word for Mission pump parts. So, for greater pump efficiency, choose all Mission parts, first choice of the industry.

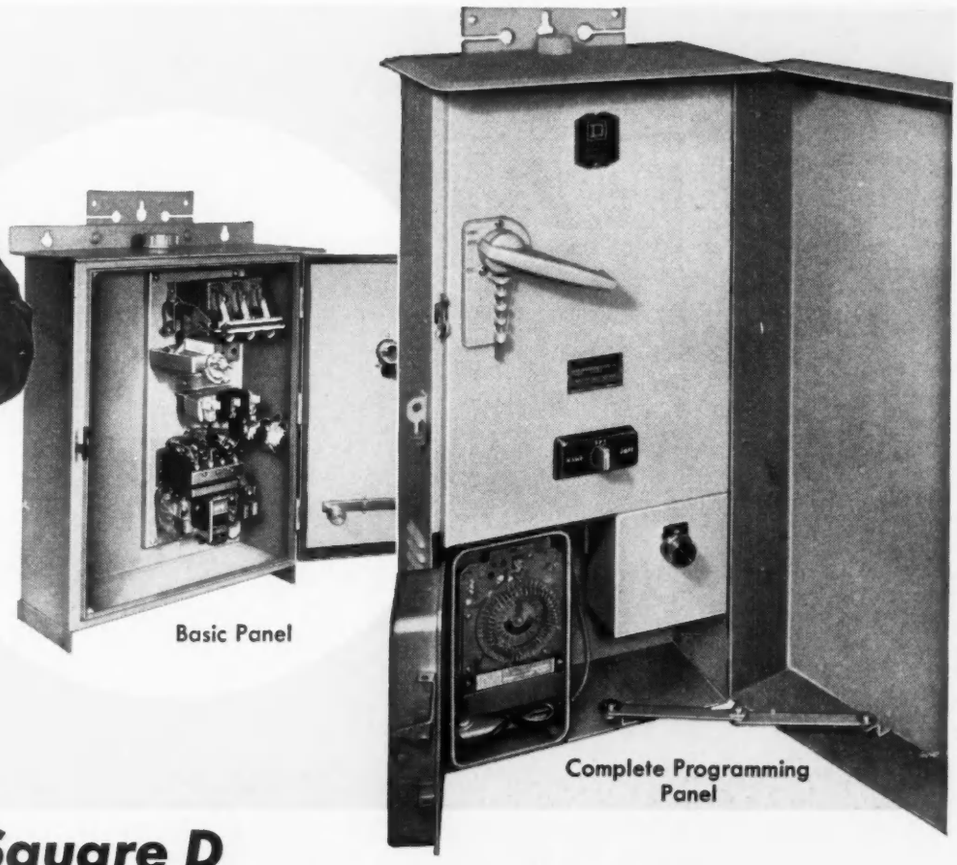
specify Mission all the way for greater pump efficiency



MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas • Cable Address "MISSCO"
Export Office: 30 Rockefeller Plaza, New York • In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • cable address "MISSOMAN"

"What kind of Pumping Control do YOU need?"



Basic Panel

Complete Programming Panel

Square D can deliver it from Stock!

BASIC PANEL can be tailored to fit your needs—

- NEMA Type 3 "weatherproof" enclosure protects against rain, sleet, hail, snow and dust.
- simplified installation—convenient knockouts for easy wiring, designed for either wall or pole mounting, or available with pedestal mounting feet if desired
- oversized enclosure permits field installation of additional features if required
- choice of fusible disconnect switch or circuit breaker
- HAND-OFF-AUTO selector switch
- available in ratings up to NEMA Size 4 to handle up to 100 hp

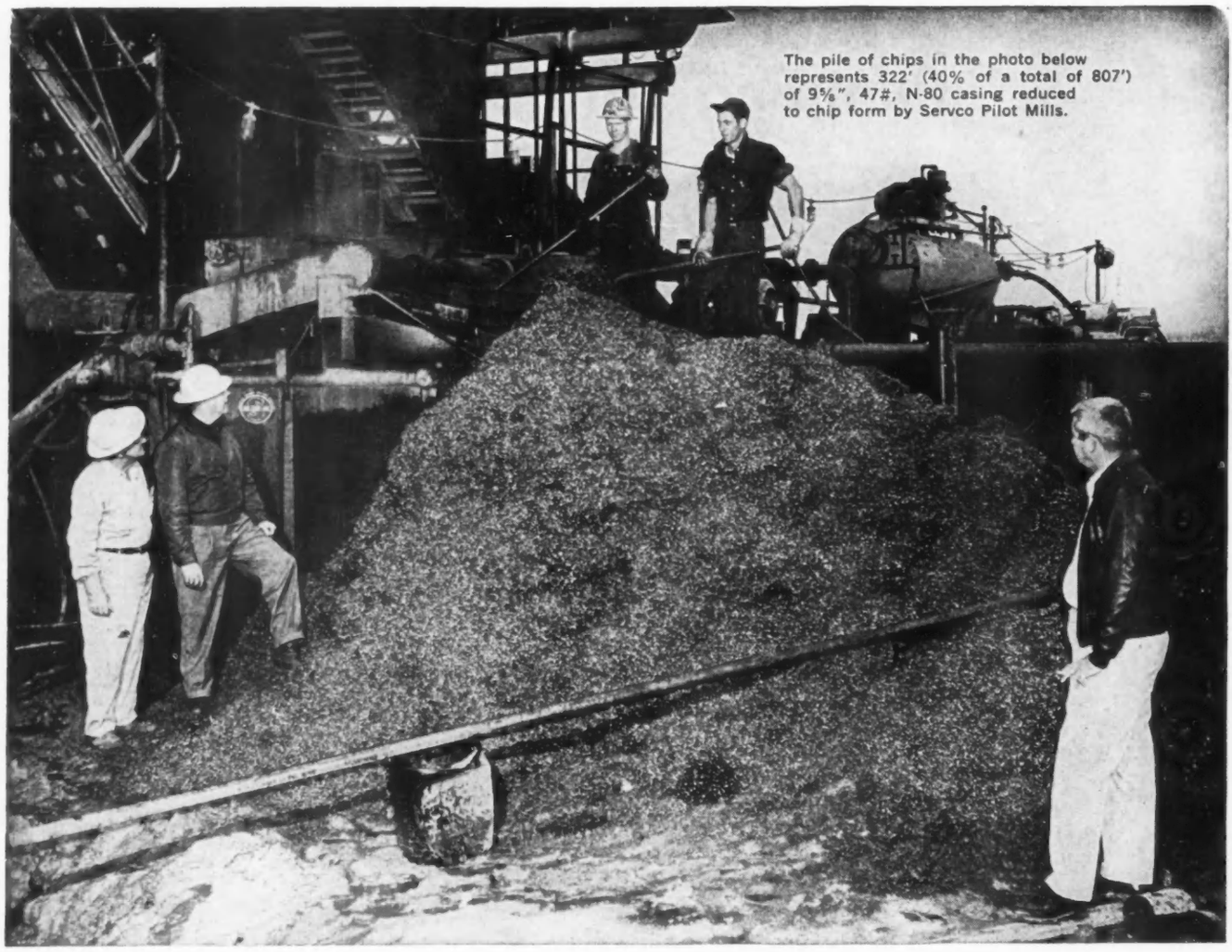
COMPLETE PROGRAMMING PANEL has every feature you need for oil well pumping—

- two types—one for operation up to 600 volts, another for 762-volt systems
- gasketed inner door isolates "live" parts—NEMA Type 3 enclosure gives complete weather protection
- overload relays in separate ventilated compartment to prevent nuisance tripping
- time clock has trip tabs for easy pumping program setup
- undervoltage release relay drops out on power failure, provides time-delay restart for staggered starting when power is restored
- built-in lightning arrester

Write for Bulletin 8944. Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

SQUARE D COMPANY

—wherever electricity is distributed and controlled



The pile of chips in the photo below represents 322′ (40% of a total of 807′) of 9⅝", 47#, N-80 casing reduced to chip form by Servco Pilot Mills.

Servco Pilot Mills mill 807′ of 9⅝", 47#, N-80 casing at an average rate of 4.6′ per hour!

In running a long string of 9⅝", 47#, N-80 X-line casing, the pipe became stuck at 5862′. Free pipe was recovered to 4139′. Approximately one month's fishing time was then spent in cutting and pulling 700′ of casing. At this point SERVCO was called on the job. *In the next 12 days eleven* SERVCO *Pilot Mills milled 807′ of casing (37,929# of steel), including 4 centralizers and 18 couplings, at an average rate of 4.6′ per hour (216# of steel per hour).*

The Pilot Mills used on this job were dressed with SERVCOLOY "S," SERVCO's unique patented steel cutting carbide material. Their performance is typical of the results SERVCO mills give every day. You can obtain these same results with any of SERVCO's tools—they are revolutionizing down-hole fishing and recompletion work.

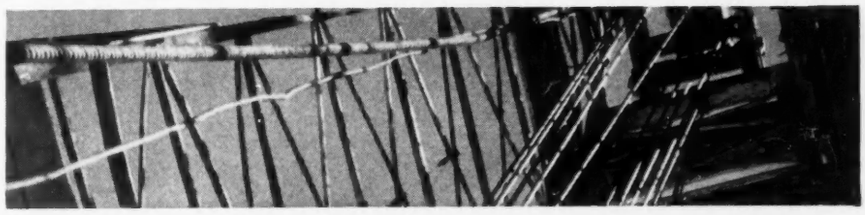
Ask your SERVCO representative for information. He has the results from nearly 4000 successful jobs to help you.

SERVCO

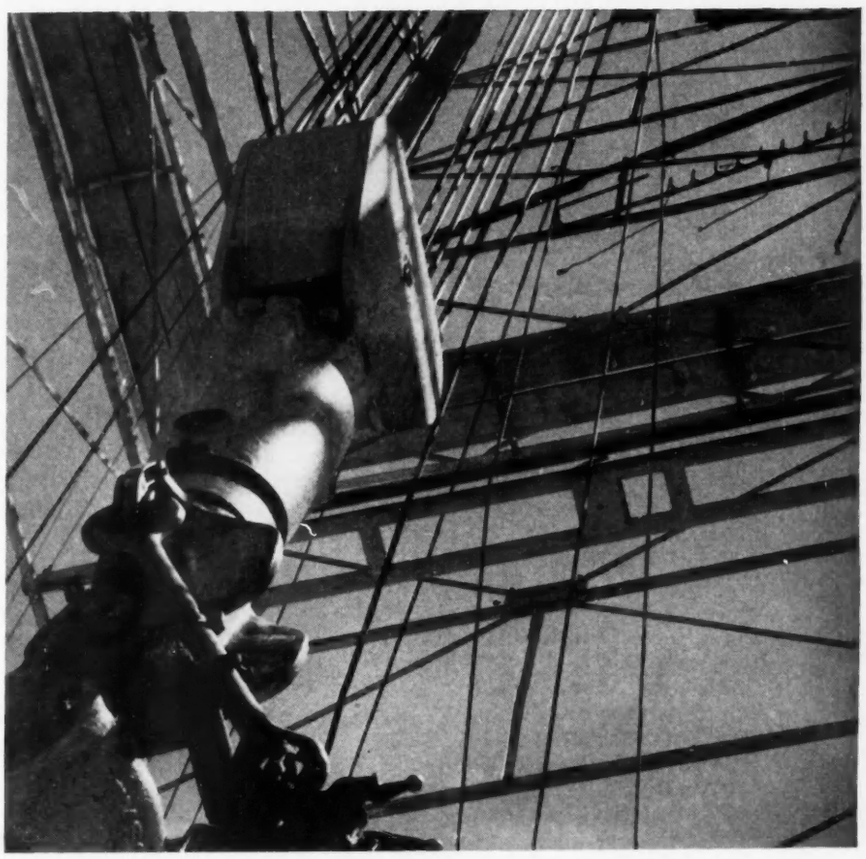
...the modern drilling tools

General Offices:
2440 Cerritos Avenue,
Long Beach 6, California
Canada: 6909 104th Street, Edmonton, Alberta
Venezuela: Maracaibo
France: 106 rue Lauriston, Paris 16
Trinidad: San Fernando
Field Offices: Ventura, Bakersfield, Lafayette, Harvey, Casper, Oklahoma City, Houston, Odessa, Williston

What is more important for efficient, economical drilling and completion than your mud and cement programs?



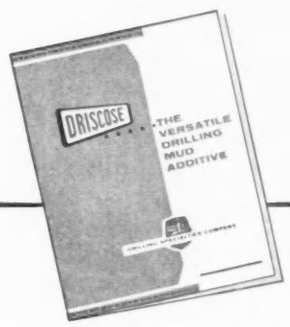
Rig up for Lower Cost Drilling and Completion...with DRISCOSE* and DIACEL**



Let us give you the benefit of experience gained over many years on thousands of wells. **Drilling muds and cement systems are our only business.**

Profit from the continuing development work done in our laboratories as well as from the assistance of our experienced field engineers. Our knowledge of up-to-date techniques can help you keep drilling and completion costs at a minimum.

For complete details . . . for the name and location of the nearest Drilling Specialties Company field engineer—write or call today.



Technical Literature

Driscose . . . The Versatile Drilling Mud Additive—A complete survey on Driscose High-Purity Mud Additives. Up-to-date information on the latest mud techniques. Write for your copy of this bulletin, D-20, today.

Also, complete DIACEL cementing literature, data and technical reprints are available.

**A trademark

*Driscose is a trademark for Sodium Carboxymethylcellulose

DRILLING SPECIALTIES COMPANY
Bartlesville, Oklahoma

For more data on advertised products, use cards, last page

Brass Tacks

FROM HALLIBURTON

Successful Jobs Show Why Operators Prefer Halliburton Testing Services

Versatile Halliburton Tools Test Four Zones On Single Round Trip

Covington County, Mississippi—Four separate zones from 14,240′ to 13,126′ were individually tested by Halliburton on a single round trip. Keying the success of the operation was a testing string including Halliburton's versatile Retrievable Test-Treat-Squeeze (RTTS) Packer, Retrievable Cup-Type Bridge Plug, and Retrievable Valve Tester (RVT). Here's how the system worked:

1. Drillable, permanent-type bridge plug set at 14,402′ to isolate sections below.
2. Testing string run with RVT in running case above RTTS Packer and Retrievable Cup-Type Bridge Plug below it.
3. At 14,348′, Retrievable Bridge Plug was set, RTTS Packer freed from Bridge Plug and set at 14,213′ to test through existing perforations.
4. RVT tool operated to record flowing and closed-in pressures, then retrieved on wire line.
5. Test recovery reversed from string, RTTS Packer unseated and re-latched to Retrievable Bridge Plug.
6. String moved up; perforations made with wire line tools run through the full-opening RTTS Packer, and testing operation repeated at three other shallower zones.

The operator was well pleased both with the reliable results as well as the sizable savings. Since the Retrievable Cup-Type Bridge Plug and RTTS Packer combination can straddle any interval, regardless of thickness, compared with other methods, this tool system saved at least three round trips and several subsequent bridge plug drill-outs.

New Halliburton Tools Record Pressure Changes In Slim Holes

Hardin County, Texas — All of the desired formation pressure changes were recorded in a test performed in 3½″ liner on a perforated interval from 9,200′ to 9,216′. At this depth, the casing contained 16.5 lb. per gal. mud and had a temperature of 175°F.

Halliburton testing assembly included a 1¾″ O.D. Hydro-Spring Tester with 1¾″ O.D. Locked Open By-Pass, 1¾″ O.D. Circulating Valve, B.T. (Bourdon Tube) Pressure Recording Device in 1¾″ running case, 1-11/16″ jars and a 2-11/16″ O.D. RTTS Packer.

The packer was set and the Hydro-Spring Tester opened at the desired interval. The well flowed pipe line oil after one hour. Upon completion of the test, reverse circulation cleared the recovery from the well and the testing equipment was removed.

Single Round Trip Acidizes 12 Zones With Halliburton Special Tool Team

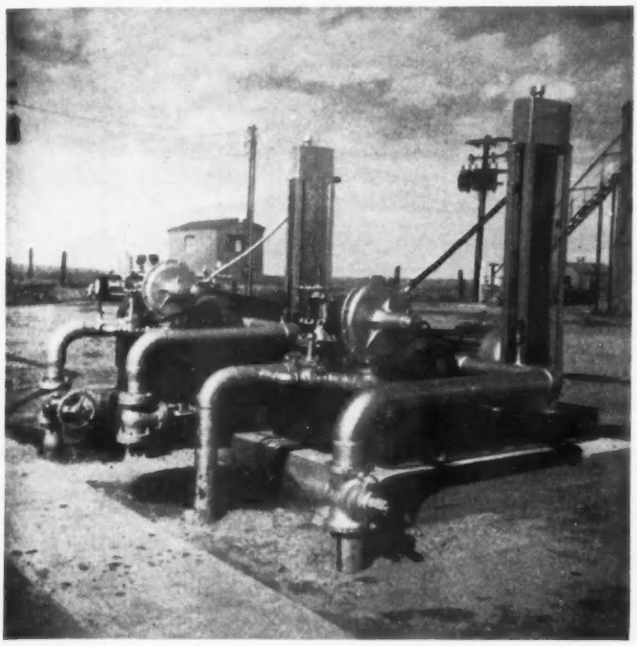
Gaines County, Texas — Twelve different zones were isolated and treated in 16½ hours during a single trip with a 4½″ Retrievable Cup-Type Bridge Plug and RTTS Packer on the drill string. Performing this feat called for running the Retrievable Bridge Plug below the RTTS Packer to 6,960′. Then the plug was set and the RTTS Packer was easily disengaged, pulled to 6,924′, and set. This zone was acidized with 500 gallons of acid. The pressure was bled off, the RTTS Packer was unseated and lowered to engage and unseat the retrievable plug. This operation was repeated successfully treating twelve different zones.

For reliable testing results...call your experienced Halliburton tester.

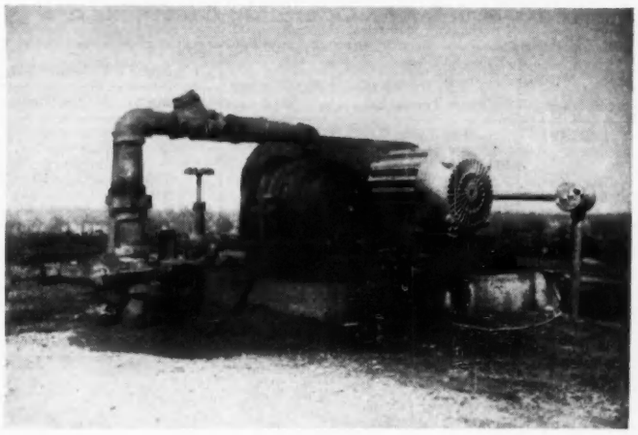
TESTING AND SPECIAL TOOLS SERVICES

Halliburton
COMPANY . DUNCAN, OKLAHOMA

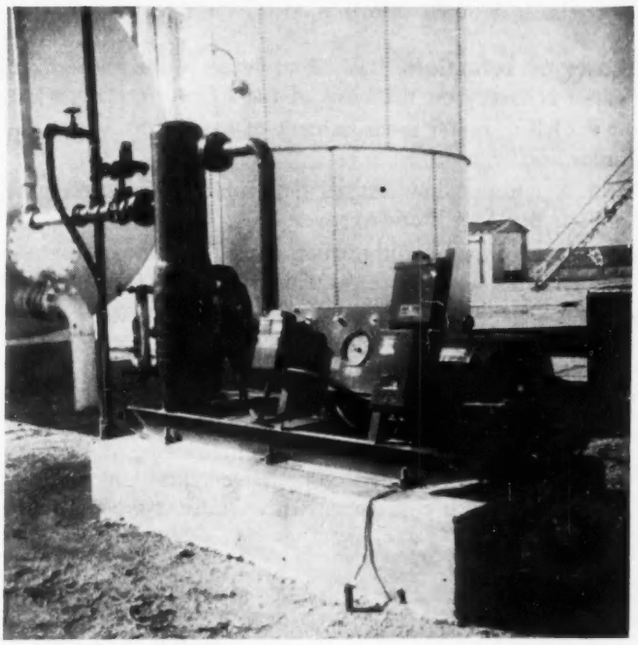
FIGURE 1—Typical compressor units used on Conoco's vapor recovery systems in the Denver-Julesburg Basin.



Plum Bush Creek Unit—belt drive, sliding vane type compressor with jacket water cooler, radiator.



Kejr Unit—belt drive, double impeller type compressor.



Little Beaver "D" Sand Unit—direct drive, sliding vane type compressor with inlet scrubber.

Stock tank vapor recovery pays off in the Rockies

Lease conservation measure grosses Conoco about $30,000 per month in Denver-Julesburg Basin operations. Equipment pays out in 15-27 days

By T. R. Blevins, Staff Engineer, Continental Oil Co., Denver and
F. G. Van Matre, District Engineer, Continental Oil Co., Fort Morgan, Col.

CONTINENTAL OIL COMPANY has installed five lease vapor recovery systems in Denver-Julesburg basin fields near Fort Morgan, Col., which in addition to conserving stock tank vapors formerly vented to atmosphere, are providing a gross monthly revenue of $29,440 to the primary producer and plant operator.

The attractive economics and successful operation of these units has caused Conoco to survey its entire producing operations in the Rocky Mountain area for possible additional installations. Figure 1 shows several of these Conoco installations.

Large volumes of stock tank vapors have been made available in the Denver-Julesburg Basin because of increasing acceptance of lease automatic custody transfer (LACT). This fact, coupled with the strategic location of gasoline plants in the area, which provide a market for the gas and recovered liquids, has caused increasing interest in vapor recovery systems.

The initial vapor recovery system was installed at the Little Beaver "D" Sand Unit LACT stock tank in October, 1960. Four additional systems were installed on the Big Beaver, Plum Bush Creek Unit, Little Beaver East

TABLE 1—Equipment, Operating Conditions and Costs—Denver-Julesburg Area Vapor Recovery Systems

Area	Type Installed	Production B/d	CAPACITY MSCFPD		PRESSURES PSIG		Gas Gravity	Hp.	Installed Cost, $	$/Hp.
			Design	Actual	Suction	Discharge				
LBDSU	Sliding Vane..... Direct Drive	2,000	100	88	4 oz.	8	1.900	5	1,975	395
Big Beaver	Sliding Vane..... Direct Drive	1,900	415	415	15	39	1.335	30	3,980	133
PBCU	Sliding Vane..... Belt Drive	9,100	250 400	210 430	4 oz. 4 oz.	24 24	1.710 1.365	20 30	4,450 5,300	222 177
LBEU	Double Impeller.... Belt Drive	1,200	50	43	4 oz.	7	1.840	5	620	124
KEJR Unit	Double Impeller.... Belt Drive	1,200	50	48	4 oz.	7	1.775	5	620	124

Unit and Kejr Unit batteries through Feb. 1, 1961. These systems handle gas volumes of 43-640 Mcfd. Oil production at the batteries ranges from 1,200-9,100 bopd. Table 1 contains detailed information on the five systems.

Basis of selection. Individual leases were selected for vapor recovery on the basis of the following criteria:

- Orifice meter measurement of stock tank vapor volumes available.
- A compression test to determine anticipated gross gallons per Mcf liquid recovery.
- An economic study which considered the casinghead gas contract for the respective lease and estimated cost of the installation.

Once a battery was selected for vapor recovery, additional factors were considered prior to purchasing specific types of equipment.

Equipment. Equipment for individual leases was selected on the basis of installed cost, delivery and the desire to obtain operating experience with different types of compressors. Delivery factor was a chief consideration since any delay due to late delivery would result in a substantial loss of revenue. In addition, it was felt that several different makes of units should be used so operating experience gained could be applied to equipment selection on future vapor recovery projects.

All five installations were equipped with high speed (over 600 rpm) positive displacement, single stage, rotary compressors driven by electric motors. Three different makes were selected, including two sliding vane types and one double impeller type. Two of the makes are belt driven and the other is coupled directly to the motor. One type compressor has been equipped with a suction scrubber, and another has a jacket water cooler and radiator (Figure 1).

All installations were equipped with bourdon tube type pressure shutdown controls and/or automatic bypasses to prevent pulling a vacuum on any vessel.

Fields in which vapor recovery equipment has been installed were electrified. Thus, electric motor prime movers were used exclusively to drive the compressors. The

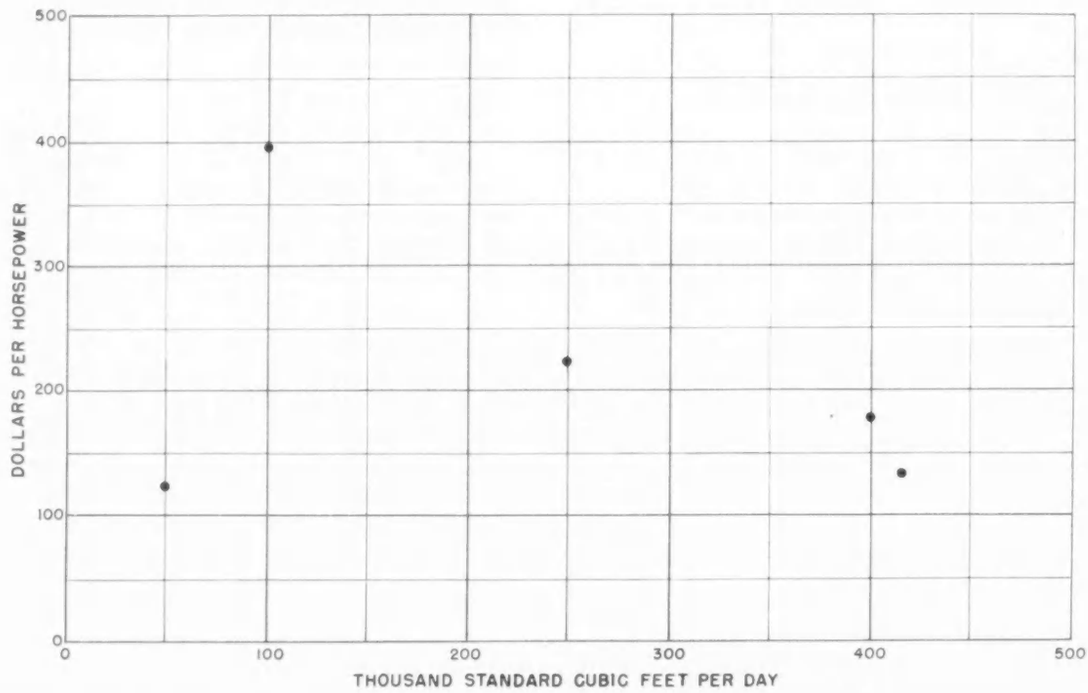


FIGURE 2—Comparison of cost to capacity of Conoco's five Denver-Julesburg Basin vapor recovery installations.

TABLE 2—Formulas for Calculating Producer and Plant Income from Vapor Recovery Projects

Producers' Income:
Liquids
Gross Gas X GPM X Liquids Returned (.25) X Net Interest (.875) X Liquids Price Per Gallon.
Residue Gas
Gross Gas X Residue Gas Returned (.50) X Net Interest (.875) X Net After Shrink (.65) X Price Per MCF.

Plant Income:
Liquids
Gross Gas X GPM X Liquids (.75) X Liquid Price Per Gallon.
Residue Gas
Gross Gas X Residue Gas (.50) X Net After Shrink (.65) X Price Per MCF.

TABLE 3—Economic Data—Little Beaver "D" Sand Unit

PRODUCER DATA	
Costs:	$ 0
Income (after royalty):	
Gas Volume	88 MSCFD
Test Content	25.0 gpm
Average Price—LPG	4.5¢/gal.
Residue Gas	14.0¢/MCF
Gross Income—LPG	$ 660/mo.
Gross Income—Residue Gas	105/mo.
Total Income	$ 765/mo.

PLANT DATA	
Costs:	
Investment	$1,525
Installation	450
Operating Expense per month	30
Total	$2,005
Income:	
Gas Volume—LACT	88 MSCFD
Test Content	25.0 gpm
Average Price—LPG	4.5¢/gal.
Residue Gas	16.0¢/MSCF
Gross Income—LPG	$2,250/mo.
Gross Income—Residue Gas	140/mo.
Total Income	$2,390/mo.
Payout Period Before Taxes and Depreciation	0.8 mos.

motors were preferable because residue gas was not available in all cases. Also, use of rich lease gas as a fuel was not economically attractive since it created additional operating problems during cold weather.

All units were skid mounted and installed on 4-inch thick concrete foundations which provide a level surface and a means for securing the compressors. However, little vibration has occurred and the hold-down factor has not been important.

Figure 2 compares installed dollars per horsepower and capacity of the various units.

Economics. Formulas used to calculate gas plant and producer income from the vapor recovery projects are shown in Table 2. Sample producer income and plant payout calculations are shown for three of the vapor recovery installations in Tables 3, 4 and 5.

For sample calculations, it was assumed that 25 percent of the liquids and 50 percent of the residue gas were credited back to the producing lease. This assumption conforms closely with actual figures for the Little Beaver Gas Plant. Prices used for residue gas and liquid products were taken from actual 1960 plant figures. Shrinkage of 35 percent is also a realistic figure for this plant.

It should be noted that the gas plant installed the vapor recovery equipment in the five fields. The primary oil producer receives from $390 to $3,795 a month in additional revenue without additional investment. Therefore, it is to the economic advantage of both producer and gas plant to investigate every producing lease for possible vapor recovery application.

TABLE 4—Economic Data—Plum Bush Creek Unit

PRODUCER DATA	
Costs:	$0
Income (after royalty):	
Gas Volume—LACT	210 MCFD
Gas Volume—Treater	430 MCFD
Test Content—LACT Vapors	27.8 gpm
Test Content—Treater Vapors	9.9 gpm
Average Price—Total LPG	4.5¢/gal.
Residue Gas	14¢/MCF
Gross Income—LPG	$ 3,020/mo.
Gross Income—Residue Gas	775/mo.
Total Income	$ 3,795/mo.

PLANT DATA	
Costs:	
Investment	$ 8,750
Installation	1,020
Operating Expense per month	230
Total Income	$10,000
Income:	
Gas Volume—LACT	210 MCFPD
Gas Volume—Treater	430 MCFPD
Test Content—LACT Vapors	27.8 gpm
Test Content—Treater Vapors	9.9 gpm
Average Price—LPG	4.5¢/gal.
Residue Gas	16.0¢/MCF
Gross Income—LPG	$10,355/mo.
Gross Income—Residue Gas	1,010/mo.
Total Income	$11,365/mo.
Payout Period—Before Taxes and Depreciation	0.9 mos.

TABLE 5—Economic Data—Little Beaver East Unit

PRODUCER DATA	
Costs:	$0
Income (after royalty):	
Gas Volume—LACT	43 MCFD
Test Content—LACT	26.5 gpm
Average Price—LPG	4.5¢/gal.
Residue Gas	14.0¢/MCF
Gross Income—LPG	$ 340/mo.
Gross Income—Residue Gas	50/mo.
Total Income	$ 390/mo.

PLANT DATA	
Costs:	
Investment	$ 470
Installation	150
Operating expense per month	30
Total	$ 650
INCOME:	
Gas Volume—LACT	43 MCFD
Test Content	26.5 gpm
Average Price—LPG	4.5¢/gal.
Residue Gas	16.0¢/mcf
Gross Income—LPG	$1,170/mo.
Gross Income—Residue Gas	70/mo.
Total Income	$1,240/mo.
Payout Period Before Taxes and Depreciation	0.5 mos.

Operation. Conoco now has operated the five vapor recovery systems in the Denver-Julesburg Basin for about 10 months. It is believed that this experience can be applied to similar installations anywhere in the Rocky Mountain area.

Operational factors listed below were determined from experience with these five systems. It is anticipated that each will be considered when planning additional vapor recovery installations in this particular area.

- Scrubbers with automatic dumps should be installed upstream of the unit if there is a possibility of liquid entering the compressor. Mist or minute drops of liquid have not affected compressor operation, but liquid slugs can damage vanes or impellers.
- Scrubber and dump valve require insulation to prevent freezing during cold weather.
- Extreme care should be taken to insure that no air enters the system through stock tank thief hatches. This can be accomplished by mounting a pressure control switch directly on the tank, or by providing a bypass to maintain a predetermined inlet pressure. The automatic

bypass is especially applicable when multiple stock tanks are manifolded together.

- It has been necessary to flush steel vaned compressors once a month with kerosine to remove sludge and prevent sticking. All vane type compressors are cleaned at regular intervals to insure freedom of movement of the vanes.
- Oil consumption on vane type compressors has averaged one quart per 24 hours.
- Compressors equipped with timing gears immersed in an oil bath have a bearing seal between impellers and gears. Some gas leakage has occurred through the bearing seal and has contaminated the oil bath. This has resulted in two bearing failures and one timing gear failure. These failures, in turn, caused extreme impeller and housing wear.
- Belt driven units are extremely flexible since speed can be adjusted to meet load conditions, and alignment is not critical.
- Phenolic resin vane compressors operate at high efficiency, possibly due to a better seating surface between vanes and rotor housing.

ACKNOWLEDGMENT

The authors wish to express appreciation to Continental Oil Company and the working interest owners of the Little Beaver Gas Plant, Bankers Life and Casualty Company, Calstar Petroleum Company, Denver Basin Oil Company, P. H. Greer Company, Lion Oil Company, Sinclair Oil and Gas Company, Sunset International Petroleum Corporation and Triangle "J" Oil Company for permission to publish this paper. Special thanks also go to Mr. B. E. Anderson for his assistance in preparing the paper. Presented at Rocky Mountain Regional Meeting, Natural Gas Processors Association, Billings, Mont., September, 1961.

About the Authors

Blevins

T. R. Blevins is a staff engineer for the Rocky Mountain Region of Continental Oil Company, Denver. After receiving his B.S. degree in mechanical engineering from Colorado State University, he joined Conoco. He worked in production engineering in Wyoming, the Four Corners Area, and later as district engineer in the Denver-Julesburg Basin.

F. G. Van Matre, Jr., is district engineer for Continental Oil Company, Fort Morgan, Colo. He received his B.S. in general science from Colorado State University and a B.S. degree in petroleum engineering from Colorado School of Mines. He has been with Conoco for the past 3½ years.

Van Matre

PART 2

Are tubular strings being designed properly?

New nomograph simplifies casing string designs

By T. B. O'Brien,
Staff Drilling Engineer, and
W. C. Goins, Jr.,
Senior Staff Engineer, Techincal Services, Gulf Oil Corporation, Houston

THIS TWO-PART SERIES, the first complete study of casing design published, can save you time and money.

Since today's oil industry price-squeeze economics require a reevaluation of casing and tubing string design concepts, WORLD OIL obtained this in-depth analysis of a significant cost factor for your information.

Part 2 concludes this study. In addition to a new nomograph for designing casing strings, Part 2 includes the stey-by-step procedure of casing string design using standard principles and performance properties of oil field casing.

Part 1, which appeared in WORLD OIL's November issue, included:

- General casing design
- Collapse in casing design
- Burst in casing design
- Tension in casing design
- Design of tubing string
- Appendix

DESIGN EXAMPLE PROBLEMS

Standard approach

Conditions:

- 5½-inch OD casing to be set in a well to a depth of 15,000 feet
- Mud weight—14 ppg.
- Change in angle occurs in the hole at 2,000 feet and the rate of change at its most severe point is 3 degrees per 100 feet
- Maximum anticipated differential pressure that may be internally applied will be 5,000 psi, (which will occur in a frac treatment,
- Anticipate well will be emptied one day,
- Top of cement will be at 11,000 feet,
- Bottom hole pressure: $.052 \times 14 \times 15{,}000 = 10{,}920$ psi.

Since this casing may be emptied, a 0.85 collapse factor will be applied below the cement top, therefore, the collapse resistance of this section must be

$$10{,}920 \times 0.85 = 9{,}280 \text{ psi}$$

Table 1 shows that 20-pound P-110 casing meets this requirement, and since it has a collapse resistance of 10,910 psi, the collapse factor on bottom will be 1.00. Length of the 20-pound pipe to be set depends upon the pipe set above it. In collaspe design, the next section to be selected is the one which has the next lower collapse strength and lower price. Pipe selected will be set to maximum depth, with the 20-pound P-110 set form this point to total depth.

From the table, 23-pound N has 8,900 psi in collapse while 17-pound P has 8,520 psi collapse strength. Cost of 23-pound N and 17-pound P grades with LT&C is $2.60 per foot and $2.41 per foot, respectively. The 17-pound P is preferable because of its reduced weight and its lower price.

The 17-pound P setting depth is:

$$\frac{8520}{.85 \times .052 \times 14} = 13{,}750 \text{ feet}$$

Footage of 20-pound P to be run on bottom then becomes:

T.D. and setting depth of 20-pound P = 15,000 feet
Setting depth of 17-pound P = 13,750 feet
Feet of 20-pound P-110 to run = 1,250 feet

Testing the 20-pound P for meeting tension-burst requirements, we have:

Tension load:

(a) Weight in 14 ppg mud over 10 ppg mud =

$$1250 \times 20 \times \left[1 - \frac{14\text{-}10}{65.4}\right] = 23{,}500 \text{ pounds}$$

(b) Bending load while passing through the 3° angle change:

$$218 \times 5.5 \times 3 \times 5.828 = 21{,}000 \text{ pounds}$$

Total Tension = 44,500 pounds

The joint strength of 20 pound P-110 LT&C = 500,000 pounds

Tension safety factor = 11.5

Requirement is 5,000 psi with a safety factor of 1.1 = 5,500 psi

Burst strength of 20-pound P-110 = 12,640 psi

Safety factor = 2.3

Previous selection was for 17-pound P above the 20-pound P. To calculate the length of 17-pound P to be used, it is necessary to know the maximum setting depth of the pipe of next lower collapse strength, cost, and equal or lower weight. Selection is from 20-pound N, collapse 7,580 psi, and 17-pound N, collapse 5,890 psi. The costs per foot are $2.26 and $1.92, respectively, so the 17-pound N is selected. Its setting depth in collapse with .85 collapse factor is:

$$\frac{5890}{.85 \times .52 \times 14} = 9{,}550 \text{ feet}$$

This is shallower than the 11,000-foot height of the cement above which a safety factor of 1.0 is to be used, so the setting depth under this condition becomes:

$$\frac{5890}{1.0 \times .052 \times 14} = 8{,}100 \text{ feet}$$

Since this requires the 17-pound P to be set above 11,000 feet, its collapse factor must be recalculated at this point to make certain it is at least 1.0.

17-pound P collapse factor @ 11,000 feet =

$$\frac{8520}{.052 \times 14 \times 11{,}000} = 1.07$$

Therefore, it will be set to 8,100 feet with 17-pound N above.

Testing the 17-pound P LT&C for meeting tension and burst requirements, we have:

Setting Depth 13,750 to 8,100 = 5,650 feet

Tension load:

(a) Weight in 14-pound mud over 10-pound mud:

$$5650 \times 17 \times 1 - \frac{14\text{-}10}{65.3} = 90{,}500 \text{ pounds}$$

(b) Bending load while passing through 3° angle change:

$$218 \times 5.5 \times 3 \times 4.962 = 17{,}700 \text{ pounds}$$

(c) Buoyed weight of 20-pound P below = 23,500 pounds

Total tension at 8,100 feet = 131,700 pounds

The joint strength of 17-pound P LT&C = 418,000 psi

The tension safety factor is: $\frac{418{,}000}{131{,}700} = 3.17$

With a minimum required: 1.75

Burst load: Required = 5,000 psi × 1.1 safety factor = 5,500 psi

Burst value of 17-pound P = 10,640 psi which amply meets requirements

Footage of 17-pound P LT&C to be set then becomes: 5,650 feet

It was calculated previously that 17-pound N would be satisfactory for collapse above 8,100 feet. The next string to be set above the 17-pound N would be selected again from the next lower collapse strength, cost and weight consideration. The next lower is 17-pound J, but this pipe has a burst strength of only 5,320 psi, whereas 5,500 psi is required. In this case, the 17-pound N, since it meets minimum burst considerations and has ample collapse resistance (to 8,100 feet), will be set until it reaches its tension limit at 1.75 safety factor. LT&C will be used.

Tension load:

Strength of 17-pound N LT&C = 320,000 pounds

Usable strength at 1.75 safety factor:

$$\frac{320{,}000}{1.75} = 183{,}000 \text{ pounds}$$

(a) Bending load on 17-pound N =
$218 \times 5.5 \times 3 \times 4.962 = 17{,}700$ pounds

(b) Buoyed weight of 20-pound P = 23,500 pounds

TABLE 1—Physical Performance Properties of Various Grades and Sizes of Casing

Weight	Grade	Collapse (psi)	Burst (psi)	TENSION (1,000 POUNDS)								Drift (Inch)	Body Area (Sq. In.)
				Pipe Body	Ex-Line	Speed-tite	Buttress	Triple Seal	8 ROUND LT	8 ROUND ST	8 ROUND AOS		
4½-Inch													
9.5	H	2,550	3,190	...	...	...	...	...	...	96	.....	3.965	2.766
	J	3,320	4,380	210	...	...	...	...	...	128	.....	.....	.....
11.60	J	4,540	5,340	250	...	...	222	...	189	159	.....	3.875	3.338
	N	5,930	7,780	338	...	...	355	...	220	...	.....	.....	.....
	P	8,590	10,690	418	...	...	418	...	288	...	.....	.....	.....
13.50	N	7,350	9,020	384	...	...	384	...	258	...	.....	3.795	3.836
	P	10,640	12,410	480	...	...	480	...	337	...	.....	.....	.....
15.10	P	12,780	14,420	552	...	...	550	...	394	...	.....	3.701	4.407
5-Inch													
11.50	J	3,130	4,240	247	...	...	...	...	...	152	.....	4.435	3.304
13.00	J	3,930	4,870	280	...	...	280	189	210	178	.....	4.369	3.773
15.00	J	4,980	5,700	328	328	...	328	234	247	210	.....	.....	.....
	N	6,520	8,290	437	437	...	437	312	288	...	.....	.....	.....
	P	9,430	11,390	546	546	...	546	390	377	...	.....	4.283	4.374
18.00	N	8,550	10,140	527	470	...	527	388	354	...	.....	.....	.....
	P	12,390	13,940	659	587	...	659	485	463	...	.....	4.151	5.275
5½-Inch													
14.00	J	3,170	4,270	306	...	...	...	...	...	186	.....	4.887	4.029
15.50	J	3,860	4,810	338	...	321	338	235	247	211	.....	4.825	4.514
17.00	J	4,500	5,320	382	382	354	382	269	275	234	.....	4.767	4.962
	N	5,890	7,740	496	490	472	496	358	320	...	.....	.....	.....
	P	8,520	10,640	620	620	591	620	448	418	...	.....	.....	.....
20.00	N	7,580	9,190	582	521	496	582	445	382	...	.....	4.653	5.828
	P	10,910	12,640	728	652	620	728	556	500	...	.....	.....	.....
23.00	N	8,900	10,560	663	579	496	663	464	440	...	.....	4.545	6.629
	P	12,870	14,520	828	723	620	828	569	576	...	.....	.....	.....

Weight	Grade	Collapse (psi)	Burst (psi)	TENSION-1,000 POUNDS								Drift (Inch)	Body Area (Sq. In.)	AOS	
				Pipe Body	Ex-Line	Speed-Tite	Buttress	Triple Seal	8 ROUND LT	8 ROUND ST	8 ROUND AOS*			Collapse (psi)	Burst (psi)
7-Inch															
20	J	2,500	3,740	430	.....	.....	.....	.....	.....	254	.....	6.331	5.749	.....	.....
23	J	3,290	4,360	490	.....	490	490	355	344	300	.....	6.241	6.655	.....	.....
	N	4,300	6,340	665	.....	.....	665	.....	400	.....	467	.....	.....	5,650	6,340
26	J	4,060	4,980	565	504	537	565	422	395	345	.....	6.151	7.549	.....	.....
	N	5,320	7,240	755	673	717	755	562	460	.....	556	.....	.....	7,800	7,240
	P	7,220	9,960	943	841	869	943	703	602	.....	.....	.....	.....	.....	.....
29	N	6,370	8,160	845	719	740	845	653	520	.....	644	6.059	8.449	9,200	8,160
	P	9,220	11,220	1,056	899	925	1,056	816	681	.....	.....	.....	.....	.....	.....
32	N	7,400	9,060	932	804	740	932	730	578	.....	729	5.969	9.317	10,400	9,060
	P	10,700	12,460	1,164	1,004	925	1,164	874	756	.....	.....	.....	.....	.....	.....
35	N	8,420	9,960	1,017	893	740	1,017	730	635	.....	819	5.879	10.172	11,600	9,960
	P	12,180	13,690	1,271	1,115	925	1,271	874	831	.....	.....	.....	.....	.....	.....
38	N	9,080	10,800	1,096	969	740	1,096	730	688	.....	900	5.795	10.959	12,700	10,800
	P	13,130	14,850	1,369	1,209	925	1,357	874	900	.....	.....	.....	.....	.....	.....

* AOS strengths for S-95.

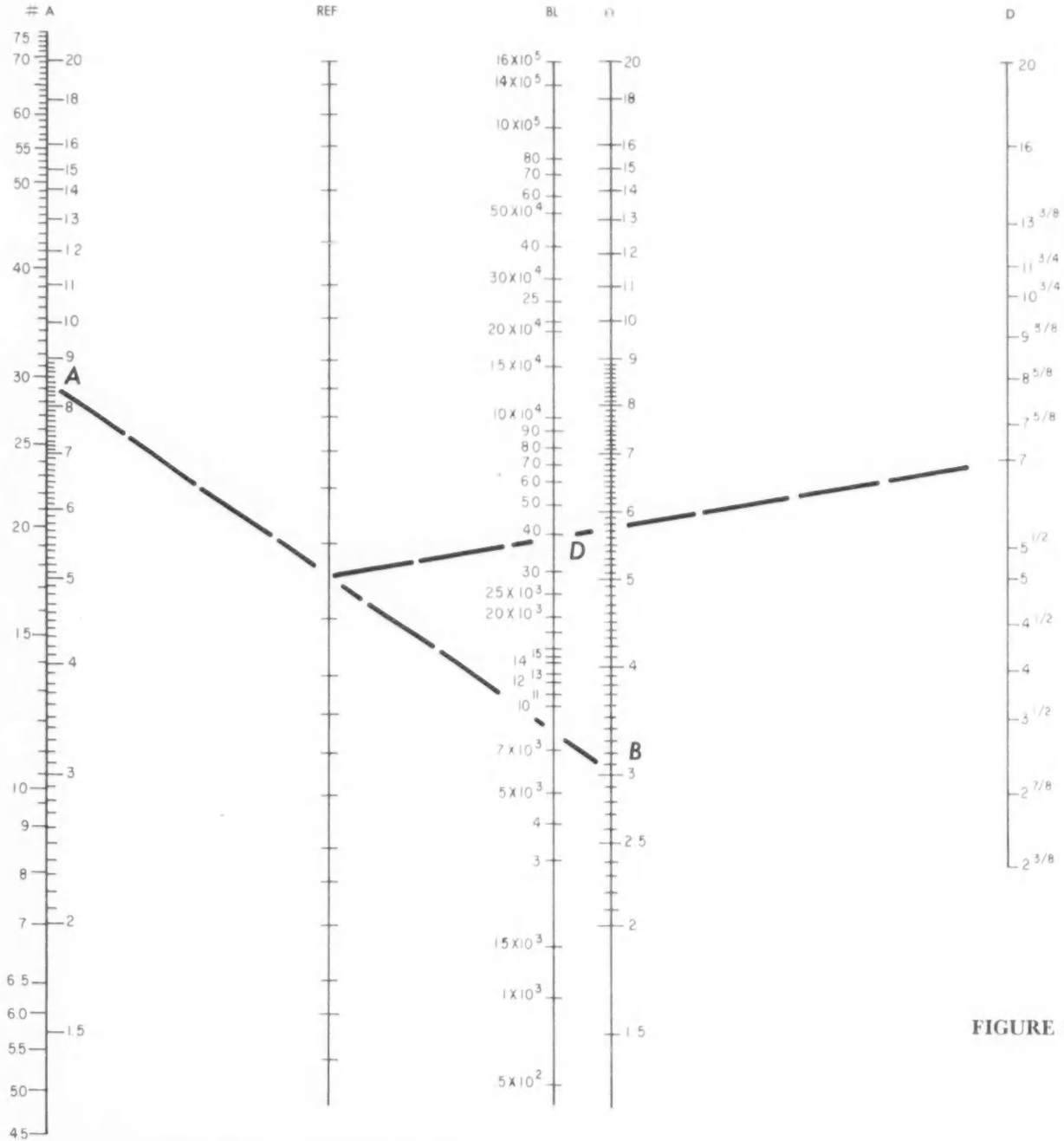
Weight	Grade	Collapse (psi)	Burst (psi)	TENSION-1,000 POUNDS								Drift (Inch)	Body Area (Sq. In.)	AOS	
				Pipe Body	Ex-Line	Speed-Tite	Buttress	Triple Seal	8 ROUND LT	8 ROUND ST	8 ROUND AOS*			Collapse (psi)	Burst (psi)
7⅝-Inch															
26.40	J	3,010	4,140	564	564	557	564	417	378	333	**	.....	.....	.....	.....
	N	3,930	6,020	752	752	744	752	542	439	.....	520	6.844	7.519	4,850	6,020
29.70	N	4,910	6,890	854	737	799	854	645	503	.....	615	6.750	8.541	7,150	6,890
	P	6,180	9,470	1,067	921	999	1,064	806	661	.....	.....	.....	.....	.....	.....
33.70	N	6,070	7,890	972	806	799	972	742	581	.....	731	6.640	9.720	8,800	7,890
	P	8,780	10,860	1,215	1,007	999	1,211	928	760	.....	.....	.....	.....	.....	.....
39.00	N	7,530	9,180	1,119	896	799	1,119	794	676	.....	877	6.500	11.192	10,600	9,180
	P	10,900	12,630	1,399	1,120	989	1,395	992	885	.....	.....	.....	.....	.....	.....

** AOS S-95.

Weight	Grade	Collapse (psi)	Burst (psi)	TENSION-1,000 POUNDS								Drift (Inch)	Body Area (Sq. In.)	AOS	
				Pipe Body	Ex-Line	Speed-Tite	Buttress	Triple Seal	8 ROUND LT	8 ROUND ST	8 ROUND AOS			Collapse (psi)	Burst (psi)
8⅝-Inch															
24	J	1,430	2,950	597	....	....	....	....	....	288	....	7.972	6.934	.....	.....
32	J	2,740	3,930	680	....	....	680	461	437	392	....	7.796	9.149	.....	.....
36	J	3,420	4,460	775	686	738	775	549	499	488	....	7.700	10.336	.....	.....
	N	4,470	6,490	1,034	916	916	1,034	733	581	....	724	.....	.....	6,060	6,490
40	N	5,390	7,300	1,156	990	1,027	1,156	854	655	....	840	7.600	11.557	7,900	7,300
	P	7,420	10,040	1,444	1,238	1,284	1,425	1,068	858	....	....	.....	.....	.....	.....
44	N	6,320	8,120	1,276	1,062	1,027	1,276	956	729	....	955	7.500	12.763	9,100	8,120
	P	9,140	11,160	1,595	1,327	1,284	1,574	1,195	954	....	....	.....	.....	.....	.....
49	N	7,370	9,040	1,412	1,062	1,027	1,412	956	812	....	1,078	7.386	14.118	10,400	9,040
	P	10,660	12,430	1,764	1,327	1,284	1,741	1,195	1,062	....	....	.....	.....	.....	.....
9⅝-Inch															
36	J	2,220	3,520	769	....	....	....	....	462	422	....	8.765	10.254	.....	.....
40	J	2,770	3,950	859	767	824	859	606	521	477	....	.....	.....	.....	.....
	N	3,530	5,750	1,145	1,022	1,089	1,145	809	606	....	744	8.679	11.454	4,230	5,750
43.50	N	4,280	6,330	1,256	1,022	1,166	1,256	921	670	....	848	.....	.....	.....	.....
	P	4,760	8,700	1,569	1,278	1,457	1,533	1,150	875	....	....	8.599	12.554	5,600	6,330
47	N	4,900	6,870	1,357	1,028	1,230	1,357	1,020	727	....	950	8.525	13.572	7,100	6,870
	P	6,120	9,440	1,696	1,352	1,538	1,656	1,276	952	....	....	.....	.....	.....	.....
53.50	N	6,110	7,930	1,555	1,239	1,230	1,555	1,165	841	....	1,118	8.379	15.547	8,850	7,930
	P	8,830	10,900	1,943	1,548	1,538	1,943	1,456	1,100	....	....	.....	.....	.....	.....
10¾-Inch															
40.50	J	1,730	3,130	859	....	....	832	576	....	450	535*	9.894	11.435	2,100	3,130
45.50	J	2,300	3,580	977	976	....	947	695	....	518	655	9.794	13.006	3,130	3,580
51.00	J	2,870	4,030	1,090	1,090	....	1,060	810	....	585	780	9.694	14.561	4,415	4,030
	N	3,750	5,860	1,456	1,450	....	1,440	1,080	....	680	....	.....	.....	.....	.....
	P	3,750	8,060	1,820	1,745	....	....	1,350	....	890	....	.....	.....	.....	.....
55.50	N	4,420	6,450	1,595	1,590	....	1,578	1,218	....	750	870	9.604	15.947	5,225	4,430
	P	5,040	8,860	1,870	1,870	....	....	1,523	....	981	....	.....	.....	.....	.....
60.70	P	6,790	9,760	2,121	1,920	....	....	1,625	....	1,081	....	9.504	17.473	.....	.....
65.70	P	8,540	10,660	2,367	....	....	....	....	....	1,180	....	9.404	18.982	.....	.....
11¾-Inch															
47.00	J	1,630	3,070	1,005	....	....	....	781	....	507	592*	10.844	13.401	2,000	3,070
54.00	J	2,270	3,560	1,168	....	....	....	956	....	593	750	10.724	15.463	3,100	3,560
60.00	J	2,840	4,010	1,298	....	....	....	1,111	....	668	895	10.616	17.300	4,360	4,010
	N	3,680	5,830	1,730	....	....	....	1,320	....	778	....	.....	.....	.....	.....
13⅜-Inch															
54.50	J	1,140	2,730	1,163	....	....	....	....	....	545	594*	12.459	15.514	1,400	2,730
61.00	J	1,670	3,090	1,312	....	....	....	....	....	613	739	12.359	17.487	2,040	3,090
68.00	J	2,140	3,450	1,459	....	....	....	....	....	695	884	12.259	19.445	2,850	3,450
72.00	N	2,880	5,380	2,976	....	....	....	....	....	868	950	12.191	29.768	3,450	3,700
77.00	N	3,550	5,760	2,210	....	....	2,140	....	....	930	....	12.119	22.147	.....	.....
85.00	N	4,320	6,360	2,440	....	....	2,364	....	....	1,029	....	12.003	24.373	.....	.....

* AOS S-80.

Weight	Grade	Collapse (psi)	Burst (psi)	TENSION (1,000 POUNDS)								Drift (Inch)	Body Area (Sq. In.)
				Pipe Body	Ex-Line	Speed-tite	Buttress	Triple Seal	8 ROUND LT	8 ROUND ST	8 ROUND AOS		
16-Inch													
65	H	640	1,640	1,000	...	...	...	...	...	423	....	15.062	18.400
75	J	1,010	2,630	1,600	...	...	...	...	...	662	....	14.936	21.403
84	J	1,480	2,980	1,805	...	...	...	...	...	753	....	14.822	24.100
109	J	2,760	3,950	2,370	...	...	...	...	...	1,003	....	14.500	31.606
118	N	4,200	6,260	3,430	...	...	...	...	...	1,273	....	14.382	34.314
20-Inch													
94	H	520	1,530	1,620	...	...	...	...	...	487	....	18.936	26.904
133	J	1,600	3,050	2,905	...	...	...	...	...	948	....	18.542	37.827



BL = 218 D Θ A − 63 D Θ POUNDS
D = O.D. CSG., INCHES
A = CROSS-SECTION AREA, SQUARE INCHES
Θ = CHANGE IN ANGLE, °/100 FT.
= CASING WEIGHT, POUNDS PER FOOT

WT. FT.	AREA	WT. FT.	AREA
4½-INCH		9⅝-INCH	
9.5	2.766	29.3	8.249
11.60	3.338	32.3	9.128
13.5	3.836	36.0	10.245
15.1	4.407	40.0	11.454
5-INCH		43.5	12.559
11.50	3.304	47.0	13.572
13.0	3.773	53.5	15.547
15.0	4.374	10¾-INCH	
18.0	5.275	32.75	9.178
5½-INCH		40.5	11.435
13.0	3.776	45.5	13.006
14.0	4.029	51.0	14.561
15.5	4.514	55.5	15.947
17.0	4.962	60.7	17.473
20.0	5.828	65.7	18.982
23.0	6.630	11¾-INCH	
7-INCH		38.0	10.791
17.0	4.912	42.0	11.944
20.0	5.749	47.0	13.401
23.0	6.656	54.0	15.463
26.0	7.549	60.0	17.300
29.0	8.449	13⅜-INCH	
32.0	9.317	48.0	13.524
35.0	10.172	54.5	15.514
38.0	10.959	61.0	17.487
7⅝-INCH		68.0	19.445
20.0	5.792	72.0	20.768
24.0	6.904	77.0	22.147
26.4	7.519	85.0	24.373
29.7	8.541	16-INCH	
33.7	9.720	55.0	15.377
39.0	11.192	65.0	18.407
8⅝-INCH		75.0	21.414
24.0	6.934	84.0	24.112
28.0	7.947	109.0	31.606
32.0	9.149	118.0	34.314
36.0	10.336	20-INCH	
40.0	11.557	94.0	26.904
44.0	12.763	133.0	37.827
49.0	14.118		

EXAMPLE

7-INCH 29-POUND CASING BEING SET PAST
A BEND WHICH CHANGES AT THE RATE OF 3° /100 FT.
BL = 218 A Θ D − 63 A Θ #
A = 8.449 SQUARE INCHES
Θ = 3° /100'
D = 7 INCH O.D. CSG.
PICK 8.449 ON LINE A
PICK 3 ON LINE Θ
MARK ON REF. LINE
PICK 7 ON LINE D
ALINE WITH POINT ON REF. LINE
READ BENDING LOAD ON LINE BL

FIGURE 2—Tensional load from bending.

(c) Buoyed weight of 17-pound P = 90,500 pounds

Total = 131,700 pounds

Length of 17-pound N = 183,000 — 131,700 = 3,260 feet

$$17\left[1-\left(\frac{14\text{-}10}{65.3}\right)\right]$$

Top of 17-pound N = 8,100 feet
—3,260 feet = 4,840 feet

Having run out of LT&C joint strength, the next choice is Buttress thread with a strength of 496,000 pounds.

It now is advisable to apply the marginal load, rather than using the Buttress thread to a safety factor of 1.75—which would result in a usable strength of 283,000 pounds. Marginal load was set when the 17-pound N LT&C was assigned a usable strength based on a 1.75 safety factor of 183,000 pounds.

Listed joint strength	=	320,000 pounds
Usable strength	=	183,000 pounds
Marginal load (strength)	=	137,000 pounds
Strength of Buttress thread 17 pounds N	=	496,000 pounds
Marginal load (strength)	=	—137,000 pounds

Usable strength = 359,000 pounds

Tension load now is:

(a) Bending load of 17-pound N Buttress	=	17,700 pounds
(b) Buoyed weight of 20-pound P	=	23,500 pounds
(c) Buoyed weight of 17-pound P	=	90,500 pounds
(d) Buoyed weight of 3,260 feet of 17-pound N LT&C	=	51,300 pounds
Total	=	183,000 pounds

Usable strength	= 359,000 pounds
Prior tension load	= 183,000 pounds
Remaining usable load	= 176,000 pounds

Since only 4,850 feet of 17-pound Buttress is needed, it is obvious that less than the permissible 176,000-pound load will be required. The actual buoyed weight of 17-pound N Buttress is:

$$4840 \times 17\left[1-\left(\frac{14\text{-}10}{65.3}\right)\right] = 77{,}500 \text{ pounds}$$

Thus, 176,000 — 77,500 = 98,500 pounds tension strength above the marginal load of 137,000 pounds remain.

Since the 17-pound N Buttress had adequate strength to the surface with bending load included, it is unnecessary to determine the feet of this pipe that could be used above the bend point with bending load omitted. If a further change in weight or grade had been required, it would have been necessary to determine that the buttress pipe had sufficient strength at the point of bending to safely support the bend load and length of 17-pound N Buttress below plus the lower segments.

If this proved adequate, the feet of 17-pound N Buttress to be used above the bend then would be determined without including bending stress.

Depth	Feet	Description, 5½-inch OD
15,000	1,250	20-pound P-110 LT&C
13,750	5,650	17-pound P-110 LT&C
8,100	3,250	17-pound N-80 LT&C
4,850	4,850	17-pound N-80 Buttress

Calculation of allowable pull:

Weight of 17-pound N-80 Buttress is:

$$4850\left[1-\left(\frac{14\text{-}10}{65.3}\right)\right]17 = 78{,}000 \text{ pounds}$$

Weight below 17-pound N-80 Buttress, incl. bending = 183,000 pounds

Total calculated weight of string = 261,000 pounds

Tension safety factor of 17-pound N-80 buttress:

$$\frac{496{,}000}{261{,}000} = 1.82$$

Allowable pull will be:

Calculated buoyed weight = 261,000 pounds

Half of marginal load: $\frac{137{,}000}{2}$ = 68,000 pounds

Allowable pull = 329,000 pounds

Minimum tension safety factor at allowable pull:

$$\frac{496{,}000}{329{,}000} = 1.50$$

NOMOGRAPH APPROACH

(See the nomograph published as a supplement to this issue)

Example Number 1

Conditions:

- 5½-inch OD casing to be set in a well to a depth of 15,000 feet,
- Mud weight—14 ppg,
- Change in angle occurs in the hole at 2,000 feet and the rate of change at its most severe point 3 degrees per 100 feet,
- Maximum anticipated differential pressure the may be internally applied will be 5,000 psi, which will occur in a frac treatment,
- Anticipate well will be emptied one day,
- Top of cement will be at 11,000 feet,
- Bottom hole pressure: .052 × 14 × 15,000 = 10,920 psi.

To determine from collapse requirements the casing to be set on bottom, move from the total depth of 15,000 feet on line A, proceed by .85 SF point on design factor line C to reference line R. From the point on line R, return by 14.0 point on mud density line D^1 to casing line B^1.

The first 5½-inch OD casing above this point of intersection is 20-pound P-110, which must be set on bottom. To find its design factor, retrace in the opposite direction from 5½-inch OD 20 pound P-110 on B^1 by 14 ppg on

D^1 to point on R, and thence from point on R to 15,000 feet on A. Read design factor at intersection on C as 1.00.

To find the first change, check on line B^1 for the next choice based on strength and cost. In this case, 23-pound N is next in strength but costs more than 20-pound P-110. Next is 17-pound P-110, which is satisfactory.

From 17-pound P-110, proceed by 14 ppg on line D^1 to line R. Spot point on line R. Proceed by .85 on line C to line A, and read setting depth for 17-pound P-110 with a .85 design factor. This point is found at 13,750 feet. This means that 15,000-13,750, or 1,250 feet of 20-pound P-110 will be run.

To find the weight of this section, find point 1,250 on line E. Line E is scaled from 1 to 10, and may be used in any multiple so long as the answer is taken in the sample multiple. From 1,250 on line E, proceed by 20-pound per foot on the left side of line F to line R; return by 14 ppg on right side of line F to line E. Read the buoyed weight of 20-pound P-110 on line E, 23,500 pounds.

The bending load must be calculated, and this can be done with the aid of the nomograph. In the table provided on the nomograph, select the area corresponding to 5½-inch OD 20-pound casing. Spot this point (5,828 square inches) on line A; proceed to line ⊖ to the point of rate of deviation change (3°/100 feet). From the point of intersection of this line with line R, proceed to the casing OD (5.5 inches) on line D. Intersection of this line with line BL will be the bending load, 21,000 pounds. Total load at the top of the 20-pound P-110 is 23,500 + 21,000 = 44,500 pounds. The joint strength of 20-pound P-110 LT&C can be taken from the table that is included with the nomograph. It is found to be 500,000, making the tension factor higher than required.

To find the next change point in the string, select the next appropriate casing to line B^1 of the collapse chart. In this example, there is 20-pound N-80 and 17-pound N-80 casing, but 20-pound N-80 costs more than 17-pound P-110; therefore, the change will be made to 17-pound N-80.

Following the same procedure as before, proceed from 17-pound N-80 on line B^1 by the 14 ppg point on line D^1 to line R, thence by the .85 point on line C to line A. This point is 9,500, which would be the setting depth of 17-pound N-80; however, this is above the top of cement and a 1.00 collapse factor must be maintained above that point (11,000 feet). It now becomes necessary to check 17-pound P-110 to be certain that it has a 1.00 collapse factor at the top of cement. This is done as follows:

From the 17-pound P-110 point on line B^1 proceed by the 14 ppg point on line D^1 to line R; proceed thence to 11,000 on line A, and read collapse factor at the intersection with line C. This intersection occurs at 1.06, which means 17-pound P-110 is satisfactory to run from the top of cement to the point at which 17-pound N-80 can be set with a 1.00 collapse factor.

Setting depth of 17-pound N-80 with a 1.00 collapse factor is found as follows:

From the 17-pound N-80 point on line B^1, proceed by the 14 ppg point on line D^1 to line R, and thence by the 1.00 point on line C to line A. This point is found at 8,050 feet, which will be the setting depth of 17-pound N-80.

Top of 20-pound P-110	13,750 feet
Setting depth of 17-pound N-80	8,050 feet
Footage of 17-pound P-110 to be set is:	5,700 feet

The buoyed weight is taken from the monograph by proceeding from the 5,700 foot point on line E by the 17-pound point on line F to line R, and thence by the 14 ppg point on line F to line E, and the buoyed weight is read as 91,000 pounds.

The bending load on 17-pound P-110 is read as described for 20-pound P-110 except that the area of 17-pound 5½-inch is used, a bending load of 17,000 pounds is read. This gives a total load at the top of the 17-pound P-110 as follows:

Weight of 20-pound P-110	23,500 pounds
Weight of 17-pound P-110	91,000 pounds
Bending load, 17-pound P-110	17,000 pounds
	131,500 pounds

The joint strength of 17-pound P-110 LT&C is found in the table on the nomograph to be 418,000 pounds and 239,000 pounds at 1.75 safety factor, which is more than adequate.

The next change would be to 17-pound J-55. But since the burst load is 5,000 psi, the burst strength required is 5,000 × 1.1 = 5,500 psi, and 17-pound N-80 is the lightest pipe which can be used. Therefore, the top of the 17-pound N-80 is found as follows:

Joint strength, 17-pound N-80 LT&C	320,000 pounds
Usable strength $\frac{320{,}000}{1.75}$	= 183,000 pounds
Marginal load	= 137,000 pounds
Usable strength 17-pound N-80 LT&C	183,000 pounds
Bending load + load to bottom of 17-pound N-80 LT&C	131,500 pounds
Strength to be used as 17-pound N-80 LT&C	51,500 pounds

To convert this to the amount of 17-pound N-80 casing that should be run, use lines E, F and R on the nomograph. The 51,500 point is found on line E, and a line through the 14 ppg point on line F is drawn to line R and thence back to line E through the 17-pound on line F, and it is found that 3,200 feet of 17-pound N-80 can be run. The top of the 17-pound P-110 was at 5,700 feet, and since 3,200 feet of 17-pound N-80 can be run, its top will be:

8,050 feet
—3,200 feet
4,850 feet

The next change will be a 17-pound N-80 Buttress, which is found from the table to have a joint strength of:

	496,000 pounds
Marginal load must be:	137,000 pounds
Usable load:	359,000 pounds

Bending load on 17-pound N-80 Buttress will be the same as on 17-pound N-80 LT&C; therefore, the total load at the bottom of the 17-pound N-80 Buttress will be 183,000 pounds.

Usable load of 17-pound N-80 Buttress	359,000 pounds
Previously imposed load	183,000 pounds
Remaining usable load	176,000 pounds

From lines E, F and R the footage of 17-pound N-80 Buttress which can be set can be determined. From the 176,000 point on line E, proceed by the 14 ppg point on line F to line R and thence by the 17 pounds per foot point on line F to line E, and read 11,100 feet as the footage that can be set. But, only 4,850 feet is needed, therefore 17-pound N-80 will be set to surface.

The string will therefore be as follows:

Depth	Feet	Description
15,000 feet	1,250	5½-inch OD 20-pound P-110 LT&C
13,750 feet	5,700	5½-inch OD 17-pound P-110 LT&C
8,050 feet	3,250	5½-inch OD 17-pound N-80 LT&C
4,850 feet	4,850	5½-inch OD 17-pound N-80 Buttress

Example Number 2

Conditions:

- 9⅝-inch casing is to be set at 8,000 feet.
- Mud weight is 10.5 pounds per gallon,
- Maximum burst pressure anticipated is 3,000 psi,
- Drilling will proceed with mud,
- Cement top is anticipated at 6,000 feet.

To find the weight and grade of 9⅝-inch casing to be set on bottom, start at 8,000 feet on line A. Since this is a protective string which will not be emptied, a 0.65 collapse factor will be used.

Therefore, from 8,000 feet on line A, proceed by the 0.65 point on line C to line R and thence by the 10.5 ppg point on line D to line B. The first 9⅝-inch OD casing to be found about the point of intersection on line B will be satisfactory. This is found to be 36-pound S-80.

If it is desirable to find the actual design factor for 36-pound S-80 at these conditions, start from the 36-pound S-80 point on line B, proceed by the 10.5 ppg point on line D to line R, and thence to 8,000 feet on line A. Read the design factor at the intersection on line C; it is found to be 0.70.

It happens that 36-pound S-80 ST&B is the least expensive casing that can be run in this well; however, a 1.00 design factor is required above the top of the cement. To find the type casing to be run from that point, proceed as before, except from the 6,000 foot point (top of cement) on line A past the 1.00 design factor point on line C to line R, and thence by the 10.5 ppg point on line D to line B.

It is found that 40-pound N-80 LT&C or 40-pound S-95 ST&C can be run. If N-80 is used, a thread crossover will have to be made; however, with S-95 no change will be required.

Also, when it is necessary to change to 36-pound S-80 because of the 1.00 design factor, no crossover will be required. The setting depth for 36-pound S-80 with a 1.00 design factor is found by the nomograph to be 5,500 feet. Thus, 40 pound S-95 will be run from 6,000 to 5,500 feet, or for a distance of 500 feet.

The tensile load to this point will consist of the following:

2,000 feet — 36-pound casing in 10.5 ppg mud and
500 feet — 40-pound casing in 10.5 ppg mud.

Weight of these two sections, if found through the use of lines E, F and R, is as follows:

From 2,000 feet on line E proceed by 36 pound on line F to line R, and thence by the 10.5 ppg point on line F to line E, where the weight is read: 71,500 pounds.

By the same method, the weight of 500 feet of 40-pound casing is found to be: 20,000 pounds

resulting in a total weight of: 91,500 pounds

The joint strength of 36-pound S-80 is: 522,000 pounds

Its usable strength (table) is: 299,000 pounds

Load applied below 5,500 feet is: 91,500 pounds

Remaining load to be used: 207,500 pounds

The additional footage of 36-pound S-80 that can be run may be ascertained from the nomograph as follows: From the 207,500 pound point on line E, proceed by the 10.5 ppg point on line F to line R, and thence by the 36-pound point on line F to line E.

The footage that can be run is read to be 5,500 feet, which means that 36-pound S-80 will be run to the surface. The string therefore appears as follows:

Depth	Feet	Description
8,000	2,000	9⅝-inch OD 36-pound S-80 ST&C
6,000	500	9⅝-inch OD 40-pound S-80 ST&C
5,500	5,500	9⅝-inch OD 36-pound S-80 ST&C

The foregoing program is completed as shown for illustrative purposes only.

In actual practice, the 500 feet of 40-pound S-95 would be replaced by 36-pound S-80. The collapse factor of 36-pound S-80 in 10.5 ppg mud at 6,000 feet is approximately .94, and the design of casing in collapse particularly is not so exact as to restrict the designer to no variation in minimum design factors.

In uniform strings, such as this would be after substitution of 36-pound S-80 for the 40-pound S-95, some deviation is allowable in tension factors. Under some conditions, it is permissable to go as low as 1.5, but these changes must be made with care and should be more closely restricted when combination strings are in use.

Example No. 3

The following illustrates the difference between the use of a 5-inch liner and a full string of 5-inch casing.

- Well is drilled to a depth of 10,000 feet
- Mud weight—10.0 ppg
- Seven-inch casing is set at 10,000 feet
- Drilling continues to 12,000 feet at which depth 170 ppg mud is required.

- A 5-inch liner is set and overlaps the 7-inch casing by 200 feet.
- Cement top outside the 7-inch is 9,800 feet.
- Gas production is anticipated.

In this case, the burst load that can be applied after completion is more severe than that which can be applied during drilling. The maximum possible burst pressure at the surface is:

$$P_b = P_f + .052\ D_2\ (W_1 - W_o)$$

$$P_b = (.052 \times 17 \times 12{,}000) + (0) = 10{,}600 \text{ psi}$$

The burst load at 9,800 feet is:

$$P_b = (.052 \times 17 \times 12{,}000) - [.052 \times 9{,}800\ (17\text{-}10)] = 14{,}160 \text{ psi}$$

The 7-inch casing will not be emptied, therefore .65 collapse factor on bottom may be used. But no section shorter than 500 feet normally is used; therefore, since there will only be 200 feet of cement and a 1.00 collapse factor is required at that point, it is necessary only to ascertain that a particular weight and grade of casing which provide a 1.00 collapse design factor at 9,800 feet also provide a .65 factor at 10,000 feet.

It is found from the nomograph that 23.0-pound S-95 is the least expensive casing that will set with a 1.00 collapse factor at 9,800 feet. But it is also found to have a burst strength of only 6,340 psi.

The least expensive casing to set, therefore, will be determined by burst consideration (14,160 psi is required). It is found that the only 7-inch casing that is suitable is 38-pound P-110, and it will be used until the burst requirement is reduced to $\frac{13{,}690}{1.1}$ psi, the usable burst strength of 35-pound P-110.

$$D_2 = \frac{17.5\ S_b - 19.2\ P_f}{W_1 - W_o} = \frac{17.5\ (13{,}690) - 19.2\ (10{,}600)}{17 - 10} =$$

5,300 feet

Therefore, the 38-pound P-110 will be run from:

	10,000 feet
	— 5,300 feet
Footage of 38-pound P-110:	4,700 feet

The next change will be to 32-pound P-110, which has a burst strength of 12,460:

$$D_2 = \frac{17.5 S_b - 19.2\ P_f}{W_1 - W_o} = \frac{17.5\ (12{,}420) - 19.2\ (10{,}600)}{17 - 10} =$$

2,150 feet

The 35-pound P-110 will be run from:	5,300 feet
to:	—2,150 feet
Total footage of 35-pound P-110	3,150 feet

The next change would be to 29-pound P-110, but its burst strength is 11,220 and it cannot be used. The 32-pound P-110 will run from: 2,150 feet

to: 0 feet

Total footage of 32-pound P-110: 2,150 feet

The tensile load that will be applied is as follows: (taken from the nomograph):

4,700 feet of 38-pound casing:	159,000 pounds
3,150 feet of 35-pound casing:	98,500 pounds
2,150 feet of 32-pound casing:	61,500 pounds
Total:	319,000 pounds

Since the burst load is in excess of 6,000 psi, the Exline joint will be used:

32-pound P-110 Exline joint strength = 1,004,000 pounds

$$\frac{1{,}004{,}000}{319{,}000} = 3.15 \text{ tension design factor}$$

Cost of this string will be approximately $70,000. A 5-inch liner consisting of 2,500 feet of 5-inch 18-pound P-110 will be run. It must have a .65 collapse factor and the casing to use was found from the nomograph. It will cost $9,100. The cost of both strings is $79,000.00.

A second method of setting in the same well would be to run 7-inch to 10,000 feet and set a full string of 5-inch casing. In this case, the burst strength of the 7-inch casing will have to be sufficient only to withstand loads that may be applied during drilling of the well. The 5-inch casing will be required only to withstand the load that would be imposed should the tubing part.

The maximum burst pressure that can be anticipated at the surface while drilling is that which would be applied if the hole is emptied and the well closed in. It is generally accepted that the formation will break down at or below the overburden pressure. Overburden pressure normally is calculated on a gradient of 1.0 psi per foot.

Therefore, maximum pressure at the surface will be 1.0 psi per foot, less the gradient of gas in the casing. If an average gradient for gas is assumed to be 0.1 per foot, the net gradient will be 0.9 psi per foot, or in our case, 9,000 psi.

Again, the cement will be brought up to 9,800 feet and the casing to be set on bottom will be found from the burst data chart on the nomograph. At bottom the burst load is:

$$P_b = G_{bd}\ D_1 - G_g\ (D_1 - D_2) - .052\ W_o\ D_2$$

Now: $D_1 = D_2$

Therefore, $P_b = 1(10{,}000) - .052(10)\ (10{,}000) =$
$= 4{,}800$ psi

It is found that 7-inch, 23-pound S-95 can be set on bottom. Its burst strength is 6,340 psi, and the nomograph shows it has a collapse factor greater than 1.0.

The first change point is where 23-pound S-95 runs out in burst. At this point, 26-pound N-80 will then be used. The top of the 23-pound S-95 is ascertained as follows:

$$D_2 = \frac{17.3\ D_1 - 17.5\ S_b}{W_o - 1.92} = \frac{17.3\ (10{,}000) - 17.5\ (6340)}{10 - 1.92} =$$

7,700 feet

Setting depth of 23-pound S-95 = 10,000 feet

Top of 23-pound S-95	=	7,700 feet
Feet of 23-pound S-95	=	2,300 feet
Weight of 23-pound S-95	=	53,000 pounds

The change will be to 29-pound N-80 casing. The burst strength of 26-pounds N-80 is:

7,240 feet

$$\text{Its top is: } D_2 = \frac{17.3D_1 - 17.5_b}{W_o - 1.92}$$

$$= \frac{17.3\ (10{,}000) - 17\ (7{,}240)}{10 - 1.92} = 5{,}700 \text{ feet}$$

Setting depth of 26-pound N-80	=	7,700 feet
Top of 26-pound	=	5,700 feet
Feet of 26-pound N-80	=	2,000 feet
Weight of 26-pound N-80	=	52,000 pounds
Weight of 23-pound S-95	=	53,000 pounds
Total	=	105,000 pounds

Since the burst load is greater than 6,000 psi, the Exline joint will be used. It has a joint strength of 673,000 pounds and the tension design factor will be high.

The next change will be to 26-pound P-110. The burst strength of the 29-pound N-80 is 8,160 pounds and its top is:

$$D_2 = \frac{17.3\ (10{,}000) - 17.5\ (8{,}160)}{10 - 1.92} = 3{,}700 \text{ feet}$$

Setting depth of 29-pound N-80	=	5,700 feet
Top of 29-pound N-80	=	3,700 feet
Feet of 29-pound N-80	=	2,000 feet
Weight of 29-pound N-80	=	58,000 pounds
Weight of 23-pound & 26-pound N-80	=	105,000 pounds
Total load to top of 29-pound N-80	=	163,000 pounds
The burst strength of 26-pound P-110	=	9,960 psi

Its top is:

$$D_2 = \frac{17.3\ (6{,}000) - 17.5\ (9{,}960)}{10 - 1.92} = -870 \text{ feet}$$

This means that in burst, 26-pound P-110 will be set to surface.

Setting depth of 26-pound P-110	=	3,700 feet
Top of 26-pound P-110	=	0 feet
Feet of 26-pound P-110	=	3,700 feet
Weight of 26-pound P-110	=	96,500 pounds
Weight below 26-pound P-110	=	163,000 pounds
		259,500 pounds

Tensile strength of 26-pound P-110 Exline is 841,000, and the tensile factor will be high. Stronger pipe is used below, and there is no need to check deeper tension loading. Cost of this string is $43,000.

It is now necessary to set a full string of 5-inch casing. The bottom hole pressure as calculated before is 10,600 psi. Cement is to be brought up to the 7-inch casing seat; therefore, a .65 collapse design factor can be used on bottom. From there, 15-pound N-80 can be run on bottom for collapse.

The burst load that can be applied can be equal to the formation pressure, or 10,610 psi. Five-inch OD 15-pound N-80 has a burst strength of 8,290 psi, which is not sufficient to withstand the maximum burst pressure; i.e.,

$$10{,}600 \times 1.1 = 11{,}660$$

The next casing to use will be 18-pound P-110, and because burst is above 6,000 psi the Exline should be used. It can be set from 12,000 feet until it reaches its limit in tension. Its tensile strength is: 587,000 pounds

$$\text{The usable strength is: } \frac{587{,}000}{1.75} = 335{,}000 \text{ pounds}$$

18-pound P-110 Exline could be set to 17,000 feet, but only 12,000 feet will be required. If a full string is set, it will cost $43,000. The cost of the 7-inch casing and 5-inch casing will be $86,500 as compared to $79,000 for the 7-inch casing and 5-inch liner, a savings of $6,500.

PERFORMANCE PROPERTIES OF OIL FIELD CASING

The following tables present the physical performance properties of the common API sizes, weights and grades of oil field casing.

American Petroleum Institute has established minimum properties for each grade of steel used in the manufacture of oil country tubular goods. Among these are the minimum yield strength, tensile strength, and elongation percent.

The following table is taken from API Standard 5A, API Specification for Casing, Tubing and Drill Pipe.[8]

Grade	Minimum Strength, psi Yield	Tensile	Elongation Min. % in 2 in. Full Section Strip Section	Specimen
F-25	25,000	40,000	40	45
H-40	40,000	60,000	27	32
J-55	55,000	75,000	20	25
N-80	80,000	100,000	16	18
P-105 (tubing)	105,000	120,000	15	17
P-110 (casing)	110,000	125,000	15	17

Data shown in the following charts are based on the minimum tensile strength and critical area for each size, weight, grade and joint.[8,9,10,11]

LITERATURE CITED

[8] API Standard 5A "Specification for Casing, Tubing, and Drill Pipe," Feb. 1960, 23rd Edition.
[9] API Standard 5AX "Specification for High-Strength Casing and Tubing," Feb. 1960, 1st Edition.
[10] API Bulletin 562 "Performance Properties of Casing and Tubing" May 1957, 7th Edition.
[11] "Tubular Products Engineering Data," A. O. Smith Corporation, Milwaukee, Wisconsin.

This two-part presentation soon will be combined and made available for field use in designing casing and tubing strings. Extra copies will be available at $1 a copy, with special rates on quantity orders. This supply will be limited. You can be certain of fulfilling your own requirements by ordering your copies now from:

Reprint Department
WORLD OIL, P. O. Box 2608
Houston 1, Texas

Small diameter well completions

Part 5–Wellheads

By R. W. Scott, Engineering Editor, World Oil

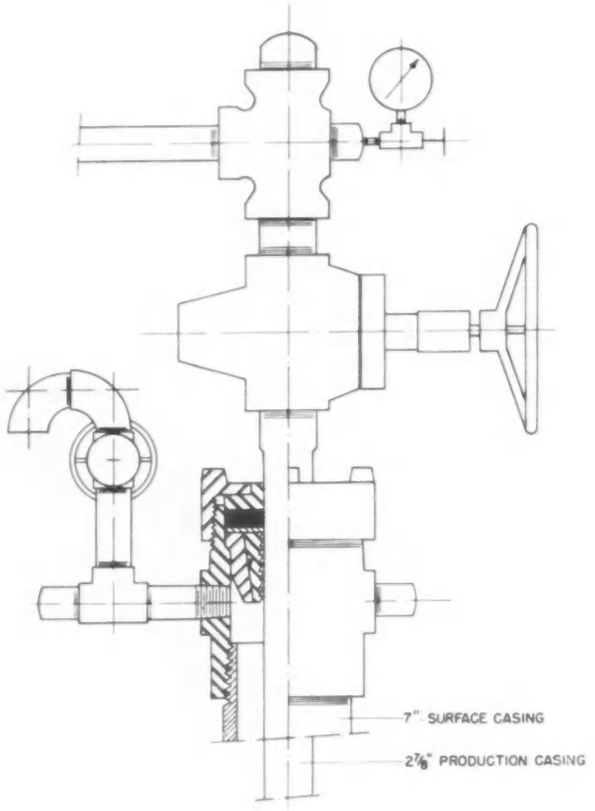


FIGURE 41—Typical low pressure, nonflanged small diameter wellhead equipment installation.

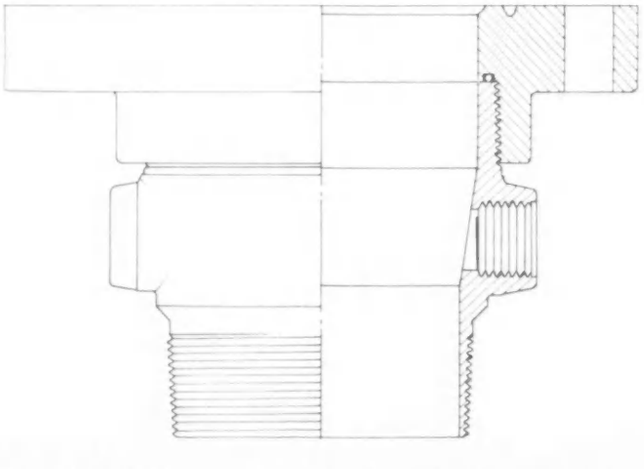


FIGURE 42—Nonflanged head with adapter flange for blowout preventers.

Casing and tubing head equipment for small diameter well completions is available in a variety of types and sizes. Single, dual, triple and quadruple casing string installations have been made, and if a sequence of reservoirs is found favorable for a quintuple string well, it is probable that equipment will be available for it, too.

As of November 1961, equipment was available for as many as eight completion zones. These heads are constructed for four strings of 2⅞-inch OD casing and macaroni hangers are provided for four concentric strings of 1½-inch OD or smaller inner tubing.

Both flanged and nonflanged type housings with threaded, mandrel, collar and/or slip-type suspensions are used. Equipment is flexible and single or multiple hanger bowls can be used interchangeably in many heads. Multiple heads are sized to pass the 4½-inch OD centralizers and other necessary downhole equipment normally used in small diameter wells. Sectionalized flanged connections permit use of screwed, individually flanged, or integral type Christmas tree valving.

In general, multiple wellhead equipment for small diameter wells has evolved from the multiple tubing hanger equipment originally developed for conventional multiple tubing string wells. The wellhead manufacturers have responded quickly to the need for small diameter well equipment and have developed many types of heads as mentioned previously. Because of this multiplicity, the following discussion is necessarily confined to examples of general types. For detailed information, the reader is referred to the various manufacturers.

SINGLE STRING EQUIPMENT

Wellheads for single wells can be classified as nonflanged and flanged. Figures 41 through 44 show examples of both types.

Nonflanged. These heads can be furnished with threaded or slip-on type bottom connections and slip, collar, threaded or mandrel type suspension. Referring to Figure 41, it can be seen that nonflanged equipment is simple and compact. The head is screwed directly to the surface pipe and contains a slip type hanger. Thus, the tree simply consists of a master valve screwed on to the tubing string which extends above the head, and other accessory flow control connections.

Slip type hangers are used to advantage if pipe sticks while running or if it is desired to "stretch" casing when hanging. If sticking occurs and too much tubing is left extending above the head, it is simply cut to the appropriate height and rethreaded to receive the master valve. If the end of a joint were to fall in the hanger proper because of mismeasurement or pipe sticking, the small diameter casing string may be picked up and respaced. If this is not

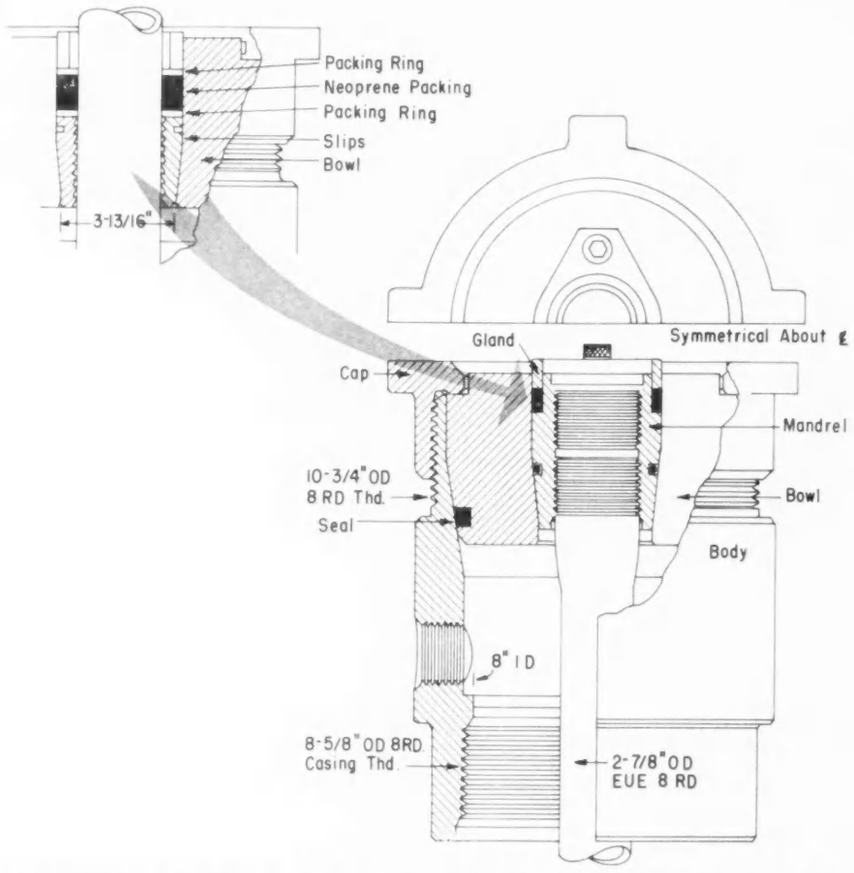


FIGURE 43—Nonflanged small diameter wellhead with mandrel type hanger. Slip hanger shown at left is interchangeable with mandrel type.

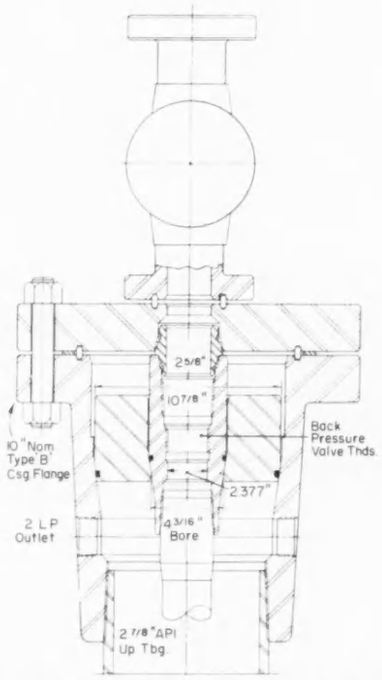


FIGURE 44—Flanged type small diameter wellhead with mandrel hanger.

possible, a ring can be cut from the surface pipe and the complete assembly lowered into the proper position.

Figure 42 shows a head equipped with an adapter flange for blowout preventer equipment. On completion, the adapter is replaced with a conventional cap. Figure 43 shows how interchangeable mandrel or slip type hangers can be used in the same bowl.

Flanged casing head adapters which can be bolted directly to any standard flanged API full opening casing head body also are available. These adapters contain hanger equipment and permit easy conversion of the conventional head.

Flanged. A typical flanged installation for higher pressure wells is shown in Figure 44. The head is screwed directly to the surface pipe but a flanged connection is provided between the head and Christmas tree. This particular installation is equipped with a mandrel type hanger threaded to receive a back pressure valve for completion purposes. As in the previous cases, the mandrel hanger is interchangeable with slip type equipment. The $4\frac{3}{16}$-inch bore allows running of $4\frac{1}{8}$-inch OD centralizer or turbilizer equipment.

MULTIPLE STRING EQUIPMENT

Both flanged and nonflanged heads also are used for multiple completion work. Essentially, the general considerations discussed above apply to multiple string equipment (interchangeable slip and mandrel hangers, clearances for centralizer equipment, etc.).

Combination casing strings have been used in many multiple installations. For example, a well might contain

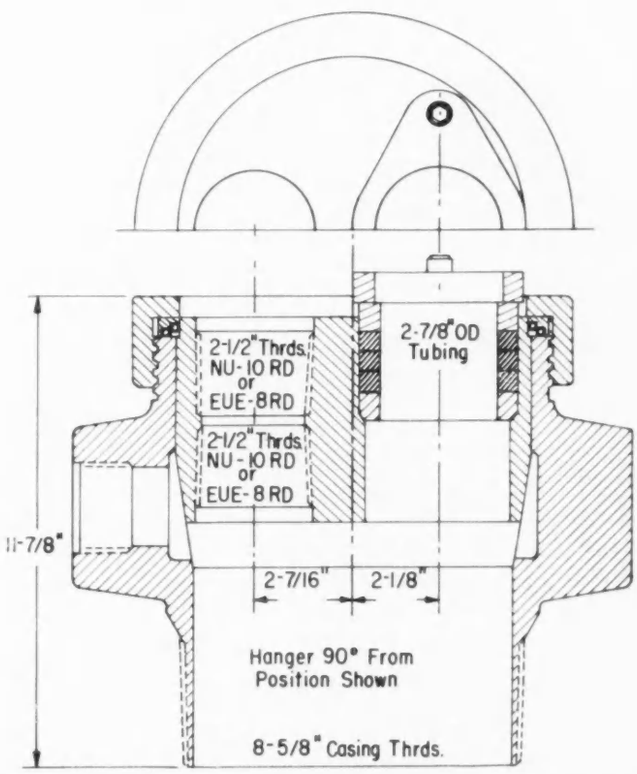


FIGURE 45—Nonflanged dual string small diameter casing head with threaded and collar type suspension.

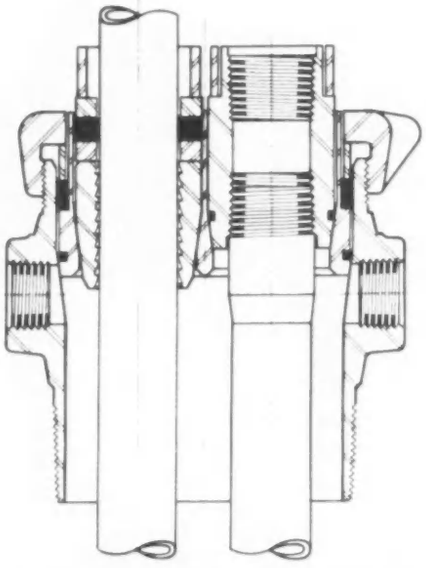


FIGURE 46—Nonflanged dual string small diameter head with interchangeable slip and mandrel hangers.

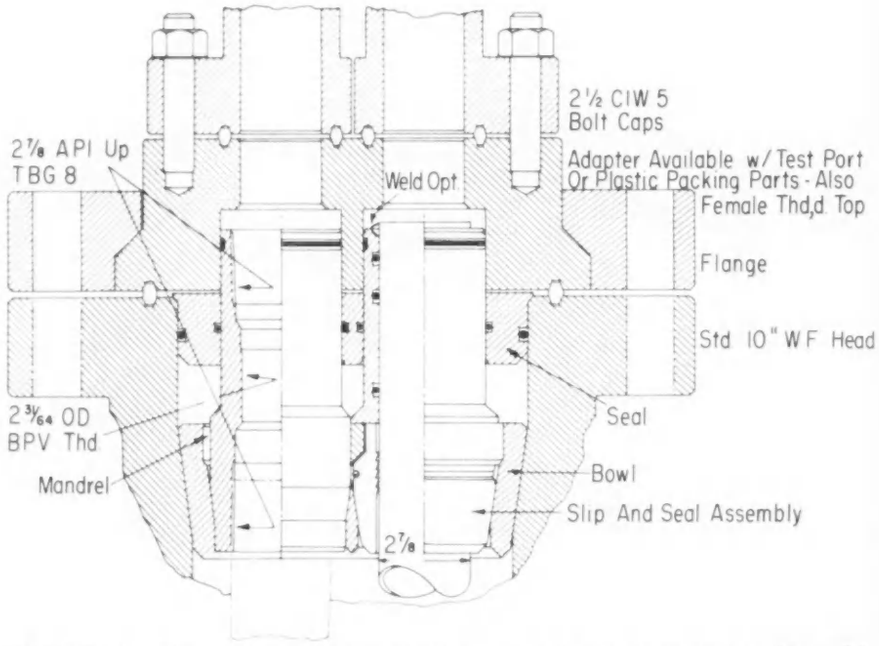


FIGURE 47—Flanged type dual small diameter casing head with interchangeable slip and mandrel type hangers.

three parallel strings consisting of two strings of 2⅞-inch OD casing and one string of 1-inch OD pipe. Obviously, many such combinations are possible depending on the particular well situation.

Figures 45-49 shows several types of multiple small diameter wellhead equipment. Heads are equipped with interchangeable bowls for multiple or single string suspension as well as interchangeable hanger elements. This feature is used to advantage, for example, when a dual head is installed in anticipation of a two-string well, but down-hole conditions dictate a single string completion. The single bowl then can be substituted and used in the dual head.

Connections on multiple heads designed for 2⅞-inch casing are furnished in 10-inch nominal size through triple string completions. Quadruple heads, because of the larger bowl required for the four casing strings, is furnished in 12-inch nominal size. In some cases, combination quadruple housings have been manufactured with a 10-inch bottom connection and a 12-inch top connection. This arrangement permits use of a full string of 10¾-inch surface casing. When heads with 12-inch bottom and top connections have been used, a single joint of 13⅜-inch casing has been run on top of the 10¾-inch surface casing.

Inner tubing strings. It has become commmon practice to install concentric strings of small tubing in small diameter cased wells. In such cases, appropriately sized tubing hangers are installed in the Christmas tree assembly above the casing head, and 1½-inch or smaller pipe is run through a small blowout preventer to the desired depth.

Small inner strings may be set on packers and used as production strings or hung free and used as production and/or kill strings. The latter method also provides means of introducing corrosion inhibitor.

To Be Continued

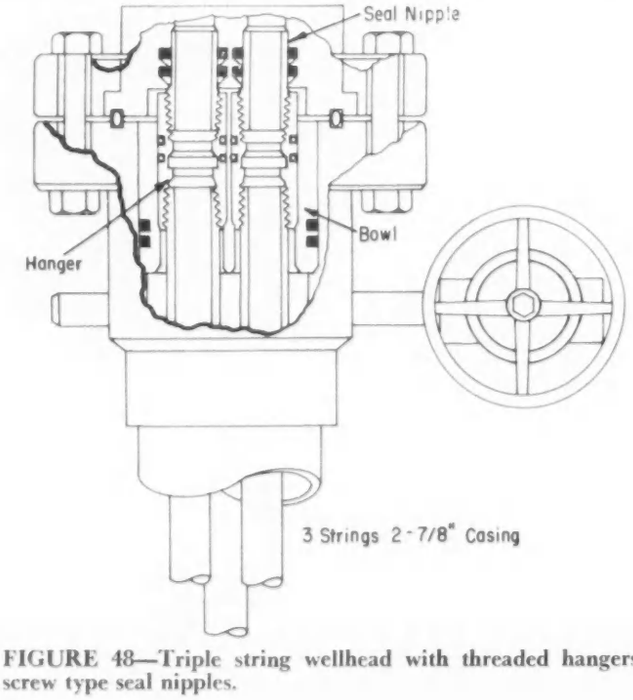


FIGURE 48—Triple string wellhead with threaded hangers, screw type seal nipples.

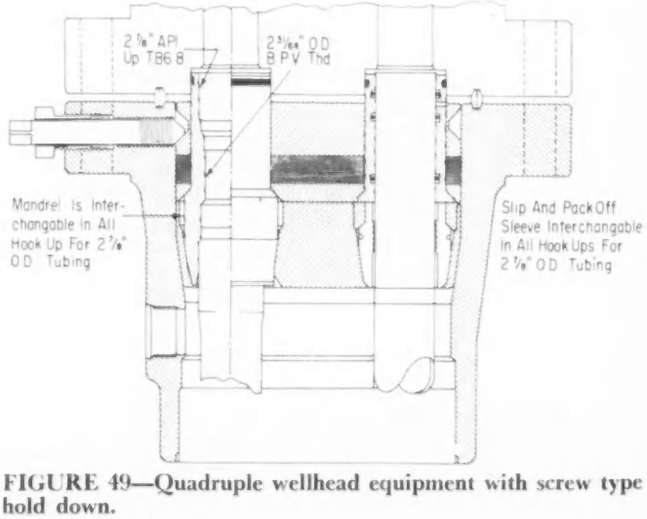

2⅞" API
Up TBG 8
2 3/64" OD
BPV Thd
Mandrel Is Interchangable In All Hook Up For 2⅞" OD Tubing
Slip And Pack Off Sleeve Interchangable In All Hook Ups For 2⅞" OD Tubing

FIGURE 49—Quadruple wellhead equipment with screw type hold down.

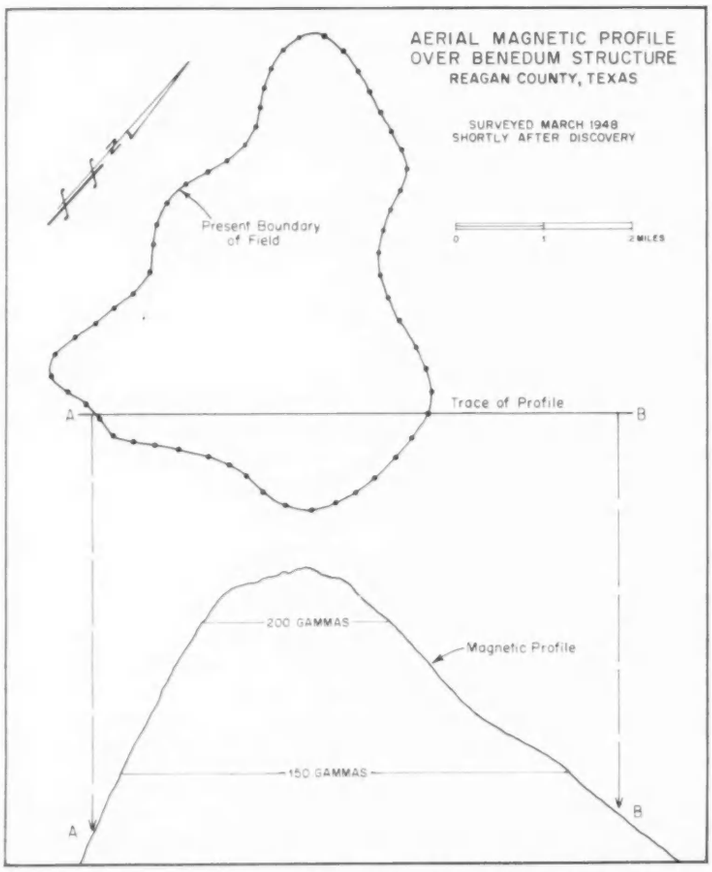


FIGURE 13—Aerial magnetic profile of Benedum structure conducted in March 1948 shortly after completion of discovery well correlates closely with present boundary of the field.

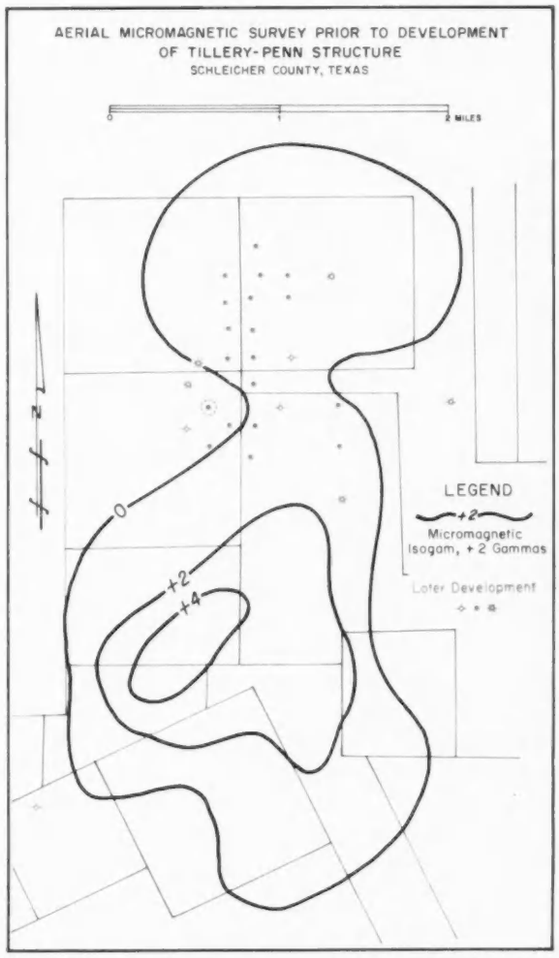


FIGURE 14—In some areas, features showing only very slight magnetic contrast are often detectable by aerial micromagnetic interpretation and prove to be oil and gas productive.

Part 4

Aeromagnetics develop new prospects and techniques

Care required to retain significant local micromagnetic details in abundant regional data

By W. P. Jenny,
Consulting Geologist and
Geophysicist, Houston

CASE HISTORIES as of the close of World War II had shown the effectiveness of correct micromagnetic interpretation of ground surveys as an exploration tool. With the advent of aerial magnetic prospecting it was hence obvious that micromagnetics could become an even better oil search technique provided that the required accuracy could be achieved in the air.

Some examples of early successful aerial micromagnetic oil prospecting and comparisons with ground surveys were published in 1951.[13]

Benedum field area, Reagan County, Texas (Figure 13). A detailed profile across Benedum oil field is shown, developed from a survey done in March 1948 shortly after the discovery well was completed. There is a close correlation between the profile and the present boundary of the field.

Tillery-Penn field, Schleicher County, Texas (Figure 14). An aerial micromagnetic picture of this area was interpreted before any development had occurred. Development to date indicates that features

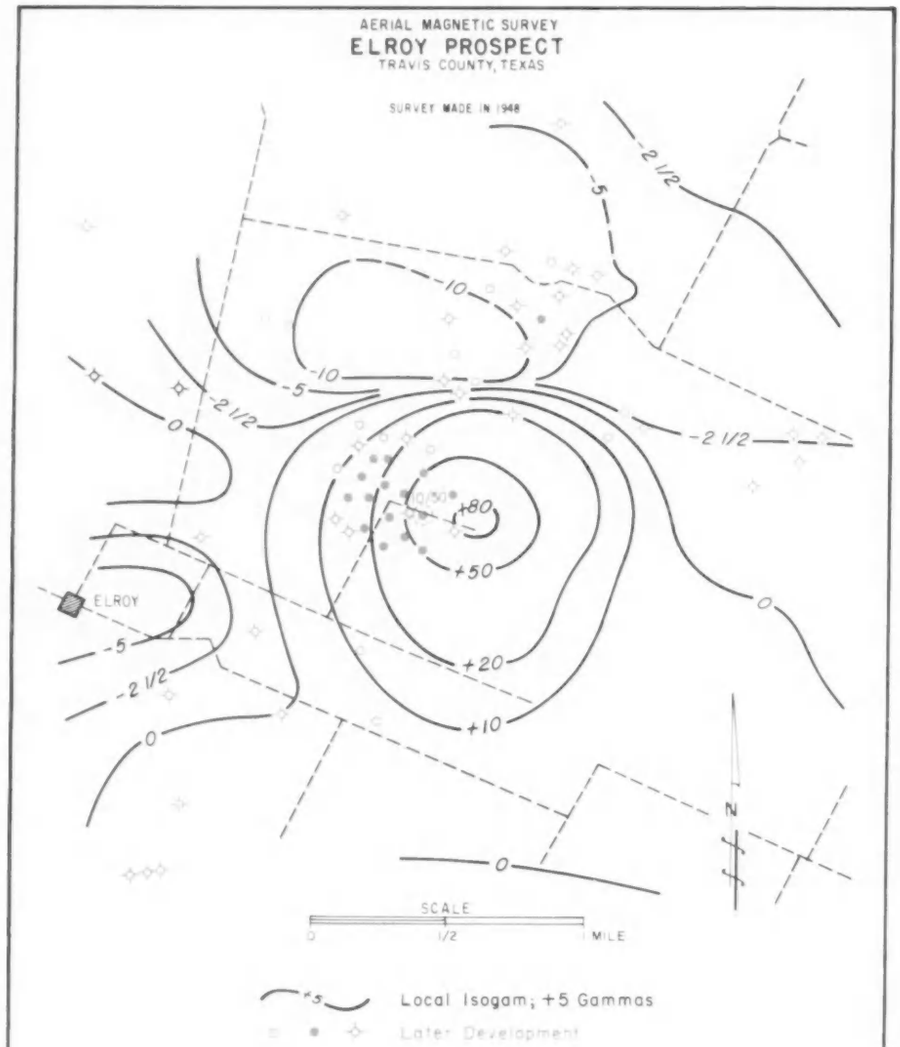


FIGURE 15—Ability of magnetic method to detect reworked ultrabasic clastic ("serpentine") plugs in Austin, Texas, vicinity has assumed renewed importance since this type of prospect is now being sought much farther southwest toward the Mexican border.

showing only very slight magnetic contrast may be indicative of oil and gas fields.

Elroy "serpentine" field, Travis County, Texas (Figure 15).[13] An aerial magnetic picture of the Elroy field is shown in black in Figure 15, with subsequent development in color.

(The effectiveness of the magnetic method in the search for oil reservoirs in reworked ultrabasic clastics which contrast readily with carbonates above and below the "serpentine" in the Austin, Texas, vicinity is well known. However, this phenomenon is reviewed here because of recent developments. In addition to the prospective old "serpentine" trend in Milam, Williamson, Travis, Bastrop, Caldwell and Guadalupe counties which includes such well-known shallow oil fields as Kimbro, Lytton Springs and Walnut Creek, there is now considerable interest in "serpentine plugs" in Uvalde, Zavala, Frio and Medina counties much farther southwest.[14] Editor's note.)

Utilizing accuracy of aerial magnetics. The usual procedure consists of constructing a magnetic or gravimetric isogam map. From this the magnetic field caused by regional structural or stratigraphic conditions is figured in one way or another and the differences between the regional and primary values are then represented in a local anomaly or residual map.

This procedure neglects much valuable detailed information between isogams. To some extent this weakness may be overcome by analyzing the magnetic or gravimetric anomalies along the surveyed profiles. But the problems are always present:

- What is regional and what is local?
- How much detailed information has been lost in the isogamming process or by arbitrarily correlating profiles?

Second derivative maps may put the problem of regional effect on a more mathematical, impersonal basis, but by the very nature of the process small anomalies are spread over considerable areas, where they interfere with, dampen or nullify each other.

Magnetic data interpreters who have compared in detail some parallel continuous aerial magnetic records of even the early surveys (e.g., one in the Williston Basin) must have been surprised by the generally close agreement of profiles as recorded in the plane and by the numerous minor anomalies from 3 to 5 gammas, which repeat in neighboring profiles.

However, one profile may show an instrumental drift and daily magnetic variation increase towards the east, while the next profile is affected by an increase towards the west. For the relatively short time necessary to survey an extended profile, it may be preliminarily presumed that the daily variation and instrumental drift are linear.

If a process could be found to eliminate instrumental drift and daily variation directly from each profile and also to correct each profile individually for regional effects according to a set rule, without going over the isogamming process, each profile could be reduced close to its base line, preserving every detail along the profile, accurately correlating it with neighboring profiles and stacking the profiles on a map, thus preserving the most minute details of the survey.

(In the fifth article to follow and to conclude this series, the author describes the "chording method" to solve problems enumerated in the preceding paragraph.)

LITERATURE CITED

(Sequence continued from Part 3 of series)

[13] Jenny, W. P., "Aerial Magnetic Oil Discoveries," World Oil 133, No. 6, 85-92 (November 1951).

[14] "Exploration Outlook 1961" World Oil 152, No. 3, p. 89 (February 15, 1961).

How to determine and remove diurnal effects precisely

Proton magnetometer base station records variations in both middle latitudes and auroral belt

By H. Wayne Hoylman,
Geophysical Consultant, Los Angeles

ONE OF THE LEAST understood requirements in making an accurate aeromagnetic survey is how to remove the diurnal variation.

Although long period, linear type fluctuations can be removed by 2- and 3-pass base loop systems[1] (developed soon after the advent of the airborne magnetometer), the short period, non-linear type fluctuations can be removed readily by using a recently-developed drift-free base station magnetometer which permits direct subtraction of the diurnal from the original airborne magnetometer profile.

During the past five years, with the advent of a sensitive proton free precession base station magnetometer, recordings have been taken revealing short fluctuations of 1- to 3-minute periods even when no magnetic storms exist. To see these short period pulsations requires an instrument sensitivity of approximately 10 gamma per inch vertically and a horizontal tape speed of at least 12 inches per hour.

From these findings and other recent aeromagnetic survey work in the United States and in northern Canadian areas currently being explored, these conclusions can be drawn:

- With development of the absolute recording magnetometer, it is now advisable to improve the quality of magnetic surveys by removing all diurnal effects through use of a base station continuous recording proton magnetometer.
- If airborne magnetometer surveys are to have the desired sensitivity and repeatability (possible with the proton free precession type instrument[2]) diurnals should be removed by a direct subtraction method.
- Mathematical tools for interpretive[3] purposes now are available for accuracies down to 0.1 gamma, compared to reliabilities hitherto available ranging from 1.0 to 5.0 gamma.
- In middle latitudes and in the auroral belt,[4] airborne magnetic data can be accurately corrected for diurnal variation by direct subtraction provided the aircraft remains within 20 to 30 miles of the base station and diurnal micro-pulsations do not exceed plus or minus 3 to 5 gamma and are of less than three minutes duration.

The most serious criticism of the original base loop system is the added cost to a survey. The triple-, double-, and single-pass loop systems, for example, add some 30 percent more to the linear miles of airborne magnetometer profiles.

. . . to remove diurnal variations from original aeromagnetic data

These suggestions will help produce an accurate aeromagnetic survey to plus or minus 1.0 gamma, reflecting geological conditions.

1. The airborne magnetometer should show a repeatable sensitivity of plus or minus 0.7 gamma.
2. Profile spacing, or horizontal distance, between originally-flown profiles must approach one-half the depth of burial but in no event be greater than the depth of burial.
3. Vertical position of airborne profiles must be held, as nearly as possible, at constant height above ground during flight survey operations.
4. The base map, using either photo or electronic fix, upon which profiles are positioned with respect to the surface of the ground must have an average positioning accuracy of plus or minus 125 feet.
5. The method used to eliminate diurnal variation must remove all of the long period (10 minute) and 90 to 95 percent of the short period (2-to 5-minute) fluctuations that are of the order of 3 to 5 gammas. The long period, linear-type fluctuations can be removed by the proper base loop system (2- and 3-pass). However, the short period, non-linear type fluctuations can be removed only by using a drift-free base station magnetometer which permits direct subtraction of the diurnal from the original airborne magnetometer profile.
6. A contour map prepared from the original data must be based upon a contour interval as determined directly from either the original profile after diurnal variation corrections have been made, or a re-plotted profile to which this correction has been applied.

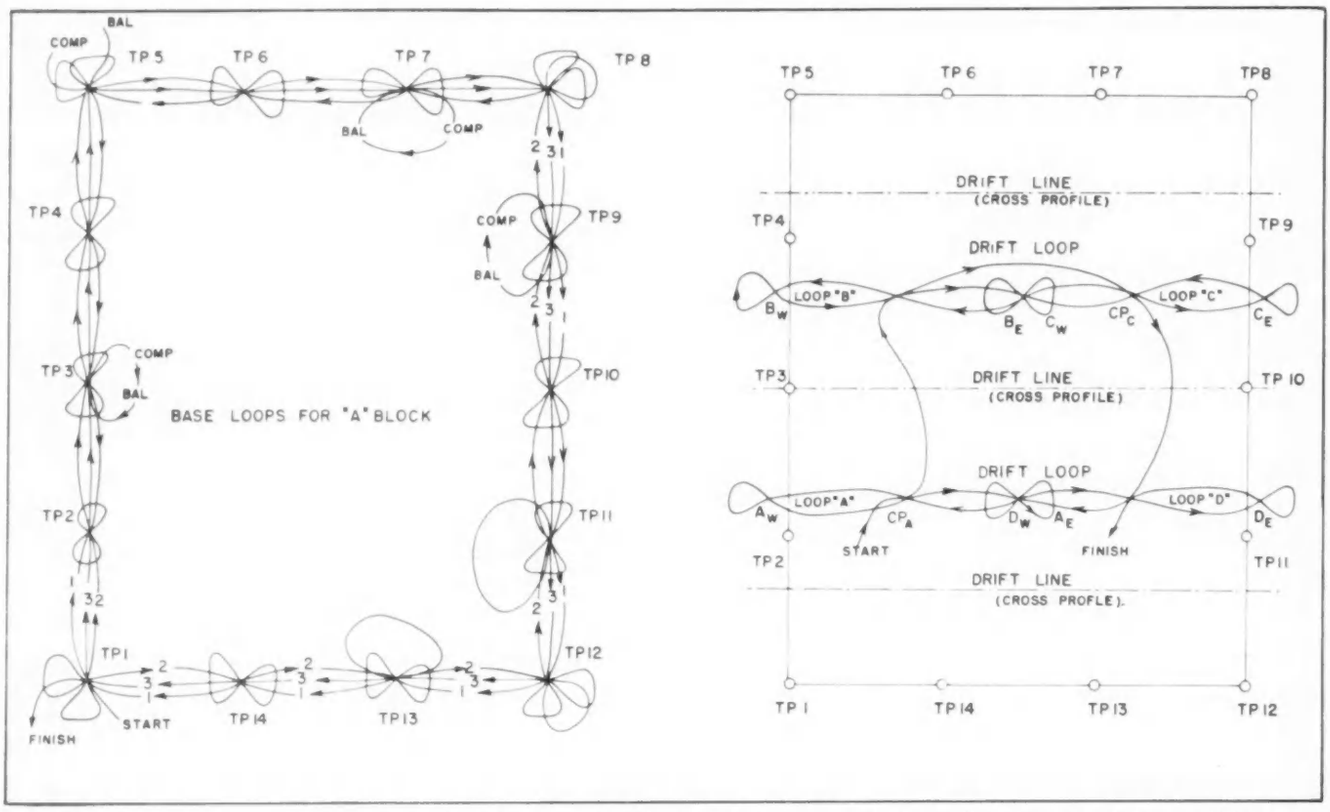
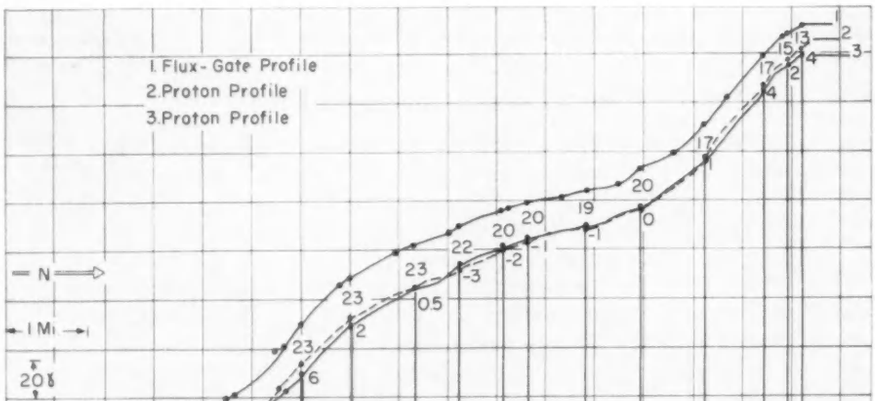


FIGURE 1—Base loops used in aeromagnetic surveys. Shown are examples of 3-pass base loops and 2-pass drift loops.

As originally designed, and in its most economical size, the base loop system (Figure 1) is a square block about 36 miles on a side. Around the periphery is a triple-pass system of flight lines. This block then is subdivided into three parts, or at 12-mile intervals, by flown 2-pass loops. Profiles are flown at right angles to the 2-pass loops. Since only five to six minutes are required to fly between the 2- and 3-pass loops, it is possible to remove the diurnal and instrumental drift so long as each is linear.

Short period diurnal pulses recorded. During the past 10 years, however, magnetic observations throughout the world have revealed magnetic fluctuations approaching storm conditions having a short period of from 2.5 to 5 minutes.[5] These short period diurnal pulses have been recorded in the greatest of detail with the proton-free precession magnetometer. They would produce erroneous conditions in a survey employing a base loop system.



EFFECT OF DIURNAL VARIATIONS ON AEROMAGNETIC PROFILES

FIGURE 2—Curves showing effects of diurnal on a 2-pass base loop. Curve 1 is a profile made with flux-gate instrument. Curves 2 and 3 were of profiles made with proton free precession instrument.

The magnitude of this type of error and effects of diurnal variation on a 10-mile section of one aeromagnetic survey (in which only single pass base lines were flown) are illustrated in Figure 2. Curve 1 was the flux gate profile. Curves 2 and 3 were made with the proton free precession magnetometer. The heavy vertical lines, spaced about ¾-mile apart, indicate profiles flown at right angles to the base lines. The geographic positioning was done on aerial photographs having a scale of 1 inch to 1,600 feet, a scale that permitted precise positioning. The numbers at various points indicate the differences, in gamma, between the curves.

At the southern (left) end of the cross-profiles a 22-gamma separation exists between the single pass flux-gate profile and the average of the two proton instrument profiles. At the north end (right) there is a difference of only 13 gamma. This differ-

ence could be a result of a diurnal varying about 10 gamma or a difference of calibration of the two instruments.

The proton free precession magnetometer[6] is an absolute instrument with fixed sensitivity that cannot be changed. The flux-gate instrument calibration may change with time.[2]

Proton instrument passes (Curves 1 and 2) fluctuate between 6 and minus 3 gamma. This non-linear variation of 9 gamma occurs in a distance of only 2 miles. Such variation in the diurnal would cause an anomaly of 9 gamma in the contoured data. If a second derivative map were made, there would be a substantial high in this area which, because it was the result of the diurnal, would have no geological significance.

It is doubtful whether most geophysicists realize how seriously the reliability of a magnetic survey is decreased when diurnal variations are not removed. Although the data were observed with instruments accurate to plus or minus 0.5 gamma, this 9-gamma error reduces reliability of a survey to about plus or minus 5 gamma.

Recent surveys with the sensitive proton type base station instrument have disclosed this most serious cause of decreased reliability of airborne surveys made with a high sensitivity (plus or minus 1.0 gamma) magnetometer.

Figure 3 illustrates another study made in 1958 intended to determine the areal extent affected by small, high frequency diurnal changes. Three continuous reading proton magnetometer base stations were set up, one at Palo Alto, Calif., a second 10 miles south and a third 23 miles south. Recordings were taken for one month. The curves represent only a short period between 4 and 11 a.m. of one of the days.

From this example, it is readily apparent that if aeromagnetic profiles had been flown in this area, and at this particular time of the day and within a radius of 20 to 25 miles from a particular base station, about 20 percent of the data would have been unreliable because of diurnal variations.

Direct subtraction of diurnals. Another test was made early in 1958 to determine whether the diurnal can be removed accurately and consistently from aeromagnetic data by direct subtraction. A base station equipped with a continuous recording proton magnetometer was set up near the intersection of generally north-south and east-west lines in the desert region near Palmdale, Calif.

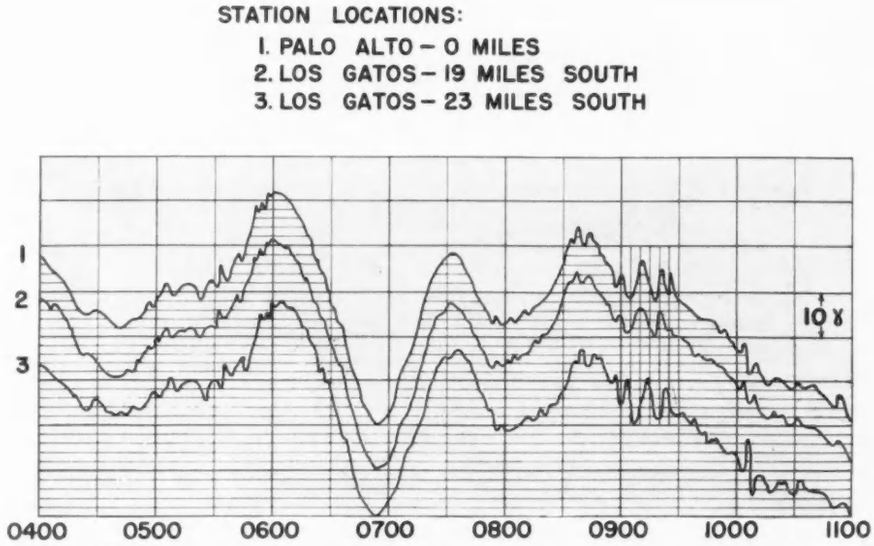


FIGURE 3—Simultaneous records of diurnal made at three proton base station magnetometers. Tests were made to determine areal extent affected by small, high-frequency diurnal changes.

These profiles were flown as often as weather permitted from late February until after mid-April. The procedure was to fly over the base station; then out and back along the east-west line; then out and back along the north-south line; then once more over the base station. Throughout these flights, a constant height above ground was maintained. Reference points were chosen along each flight line and at these points the uncorrected and corrected aeromagnetic data were determined.

In Figure 4 are diurnals recorded during the flight operations on March 24, 25 and 26, 1958.Time of the day is indicated at the bottom of each of the charts. Reference points over which the aircraft passed are indicated by the symbols R1, R2, R3, etc. Since the proton instrument is an absolute recording magnetometer, identical readings should be obtained at these reference points provided the diurnal had been removed.

Validity of this assumption is borne out by Figure 5. Here, a small portion of the March 25 recording, involving reference points R1, R2, R8, R9 and R13, along the east-west base line, is examined closely and corrected for the diurnals. On this particular day, the diurnals were particularly disturbed with short pulse variations.

Plate 1 of Figure 5 is an enlarged portion of the diurnal profile. Reference points are indicated by the five vertical lines. These same points are indicated on Plates 2, 3 and 4 of the same figure. Reference point R1 was located at the top of a magnetic high: R2 was on a steep magnetic slope; R8 was in a magnetically flat area but was near igneous outcrops; R9 was on a relatively steep magnetic slope in the vicinity of igneous outcrops;

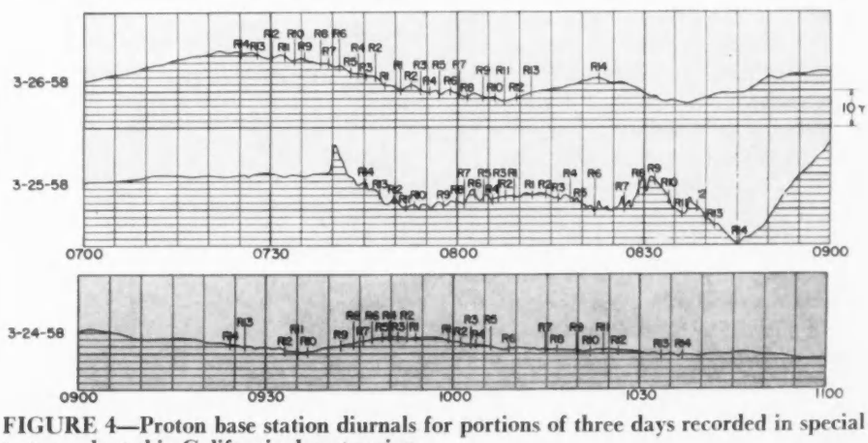


FIGURE 4—Proton base station diurnals for portions of three days recorded in special tests conducted in California desert region.

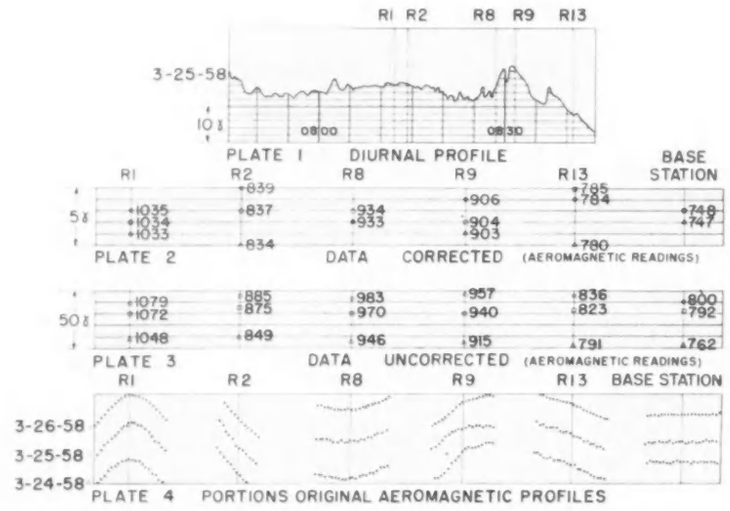


FIGURE 5—Typical example of how aeromagnetic field data is corrected for diurnal by direct subtraction using absolute recording proton base station data.

and R13 was on a moderate slope. At the far right of each plate, labeled "Base Station," are indicated the magnetics recorded from an altitude of 1,000 feet above the base station.

Plate 3 of Figure 5 shows uncorrected airborne magnetometer readings obtained at the same reference points on the same days. Above these readings, Plate 2, are the corrected data showing the magnetic readings after the diurnal had been directly subtracted from the original aeromagnetic observations. The maximum spreads of the data at the respective reference points, both before and after reduction and correction for diurnal are listed below:

Reference Point	Spread of Uncorrected Data	Spread of Corrected Data
R1	30 gamma	2 gamma
R2	35	5
R8	37	1
R9	42	3
R13	45	5
Base Sta.	38	1

The uncorrected and corrected data in Figure 5 are representative of all the data obtained during this study. Although the spread of the corrected data in every case exceeds 1.0 gamma, it is felt that if the magnetic slope is not particularly steep, the spread can be as small as 1.0 gamma even though outcrops are present.

It should be noted that the diurnal was effectively removed at reference points R8 and R9 even though the diurnal was very active and conditions would be considered as very adverse. Similar types of data were obtained also for the north-south base line.

From these data it seems reasonable that at least in middle latitudes, airborne magnetometer data can be accurately corrected for diurnal variation by direct subtraction providing two conditions are adhered to:

1) The aircraft should remain within 20 to 30 miles of the base station during field survey operations.

2) The survey should not be flown when diurnal micro-pulsations are more than plus or minus 3 to 5 gamma, and are of shorter duration than three minutes.

Several conditions besides the diurnal may have caused the final reduced readings at some reference points to have spreads of 2 to 5 gamma. These are:

- Variation of the height of the aircraft above the ground.
- Lack of coincidence of the various flight lines.
- Roll and pitch of the aircraft. This probably caused errors in the geographical positioning of the flight lines at the reference points. Correct positioning of the flight lines was extremely important at reference points located on steep magnetic slopes.

It is reasonable to predict that in middle latitudes, aeromagnetic data corrected by direct subtraction of the diurnal are more reliable than data corrected by using a 1- or 2-pass base loop system. Assuming that only one base station is needed, the over-all cost of a survey in which the direct subtraction method is used should be about the same as the one utilizing a 1- or 2-base loop system.

While the cost of obtaining field data may be increased by using a base station, this should be offset, in part, by the reduced amount of office work needed to process the data.

Far northern area. To further perfect the direct subtraction method of removing the diurnal, much work still must be done in the auroral zone. Data from the magnetic observatories in northern Canada and Alaska indicate that daily magnetic disturbances are of much greater magnitude, are of short period, and occur more frequently than in the middle latitudes.

Base station method is successful in Canada. One such survey, covering some 25,000 square miles in northeastern British Columbia and Northwest Territories,[7] was made in 1959. The area was subdivided into blocks each measuring about 35 miles north-south and 65 miles east-west. In each of these blocks, two base stations were placed about 22 miles apart. The survey was made using the proton free precession magnetometer.

A restrictive condition observed in the survey was that operations could be undertaken only when magnetic

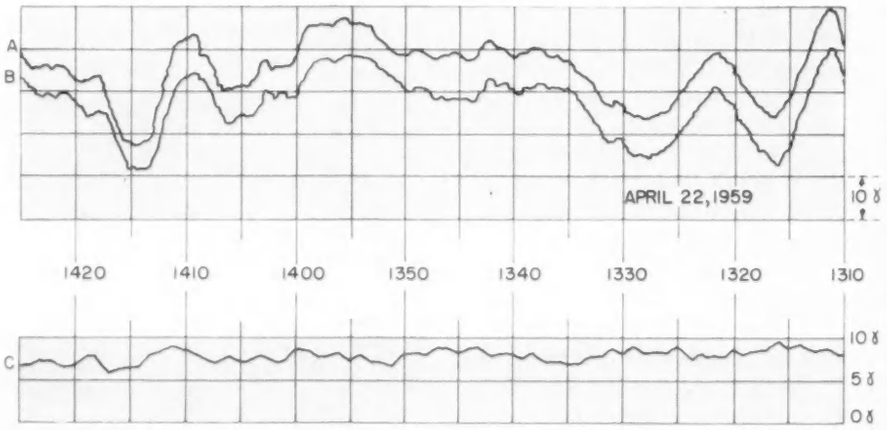


FIGURE 6—Comparison of original base station records of diurnals simultaneously recorded by two proton base station instruments located 22 miles apart in a northeast British Columbia, Canada, survey.

TABLE 1—These are absolute aeromagnetic readings at intersections of east-west traverses and north-south cross profiles after removal of diurnal by direct subtraction

	CL-1		CL-2		CL-3		CL-4	
T-35	59,978	59,981	60,141	60,137	59,832	59,825	59,473	59,473
T-34	993	996	147	141	816	812	454	450
T-33	60,007	60,009	152	148	803	800	458	456
T-32	009	008	146	142	791	790	462	460
T-31	011	014	139	134	783	780	463	458
T-30	019	024	118	116	771	770	461	456
T-29	025	028	114	112	765	762	454	449
T-28	029	033	099	099	761	757	451	449
T-27	041	044	091	091	750	751	445	440
T-26	053	054	090	088	743	739	442	439
T-25	058	059	089	085	738	737	439	438
T-24	057	058	083	082	733	731	440	436
T-23	059	057	083	079	731	729	440	437
T-22	056	055	078	077	725	723	438	441
T-21	057	056	074	074	723	720	441	441
T-20	060	059	077	078	714	711	440	442
T-19	062	065	081	082	696	691	441	442
T-18	070	068	083	085	666	666	438	442
T-17	069	070	080	...	646	644	437	442
T-16	075	074	081	082	600	602	435	440
T-15	077	077	072	075	600	603	434	437
T-14	088	087	066	069	573	574	433	433
T-13	60,101	60,101	055	058	553	557	428	430
T-12	113	111	051	052	545	546	430	431
T-11	133	132	036	041	527	531	432	432
T-10	145	143	023	023	508	509	435	435
T-9	144	146	011	014	495	497	439	442
T-8	131	127	59,998	001	499	500	431	433
T-7	126	124	976	59,980	482	485	423	428
T-6	117	117	976	978	471	469	422	426
T-5	007	012	964	966	462	466	418	420
T-4	099	098	944	945	454	456	419	421
T-3	099	100	929	933	441	441	419	421
T-2	087	091	920	926	427	430	416	421
T-1	080	081	...	923	433	439	419	421

differences between the base stations were not varying by more than plus or minus 1.5 gamma.

This is equivalent to saying that the diurnal is varying in a simultaneous manner over a 22-mile radius or whatever distance exists between the two base stations. In this particular instance, it would permit flying profile lines approximately 66 miles long.

Figure 6 shows actual recordings (Curves A and B) of the two base stations, about 22 miles apart, located 35 miles northwest of Fort Nelson, B.C. Perhaps the most important feature is the detailed similarity of the two curves. It was surprising to find such close similarity in the curves whose amplitudes range from a 25-gamma pulse over a period of about 5 minutes (at the far right) to several short period pulses (center) of 2 to 3 gammas occurring in the short interval of from one to two minutes.

Curve C of the same figure shows more clearly the actual differences, at 1-minute intervals, between the two base station records. During the 25-gamma decrease between 1310 and 1315, the difference between the records change by 4 gamma. This can be considered as a plus or minus 2 gamma. At 1410 the diurnal is moving rapidly and here the difference is plus or minus 2 gamma. Between these two periods the diurnal varies, but remains within plus or minus 1.5 gamma.

Small pulses recorded in auroral belt. These data point out the significant fact that base stations, even in the auroral belt, can record small pulsations and permit airborne magnetometer profiles to be flown even while this type of diurnal is actually occurring. It would not have been possible to remove these small pulsations from any form of base loop system in use during the past 10 years.

In the British Columbia-Northwest Territories survey just described there were many days during the spring of 1959 when the diurnals did get out of phase and when pulsations were similar but differing in occurrence by from 15 seconds to 2 minutes. These oscillations again would shift into phase, and it was possible to do considerably more flying in this area using base stations than it would have been using older aeromagnetic survey techniques.

Proving diurnals have been removed. The real test, as indicated earlier, is whether or not the diurnal has been correctly subtracted from the east-west traverses. It is necessary to fly some cross lines in a north-south direction and remove the diurnal from them. If the diurnal has been removed correctly, the magnetic readings should be identical at intersections of cross lines and traverses, or at least be within the limits of error permissible between the two base stations.

This is illustrated in Table 1, showing the magnetic differences at four cross lines designated CL-1 through CL-4. On the left are east-west traverses or profiles indicated by T-1 through T-35. The values are in absolute magnetic readings giving the total magnetic intensity at each intersection. In each of the columns headed by CL-1, CL-2, etc., the values on the right side of the vertical line are magnetic readings taken from the north-south profile; those on the left are magnetic readings taken from the east-west profiles, the latter having been flown on different days.

The differences between the two sets of readings vary from zero to 6 gamma. Out of the total of 138 intersections there are 14 identical, 13 differing by 1 gamma, 32 differing by 2 gamma, 25 by 3 gamma, and 20 by 4 gamma. There are 17 intersections with differences greater than 4 and only one greater than 6 gamma.

It is suspected that for the limited amount of differences larger than 4 gamma, the error may be due only

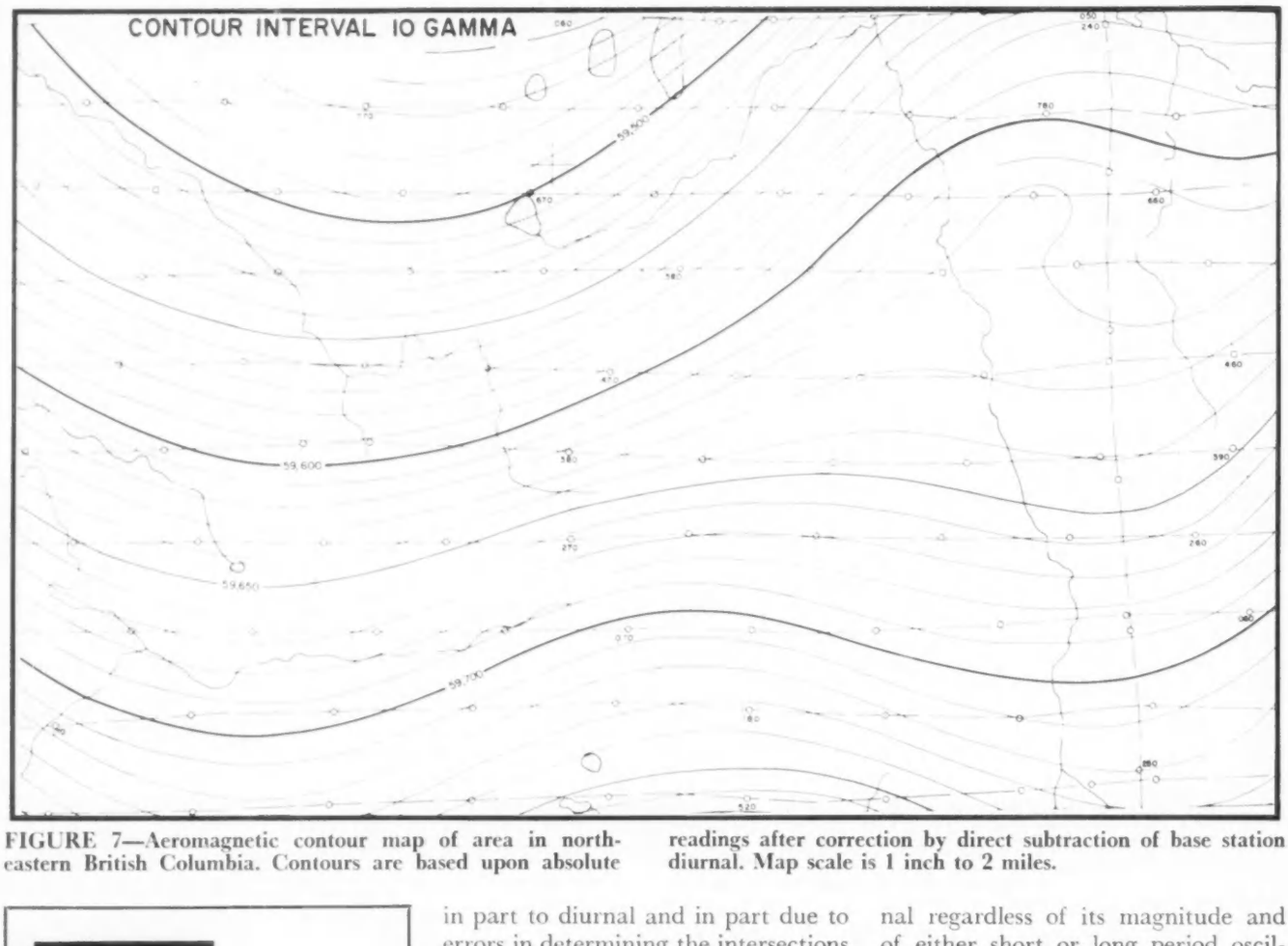


FIGURE 7—Aeromagnetic contour map of area in northeastern British Columbia. Contours are based upon absolute readings after correction by direct subtraction of base station diurnal. Map scale is 1 inch to 2 miles.

About the Author

H. Wayne Hoylman has more than 25 years of experience in geophysical exploration. He has been a consultant in Los Angeles since 1950, specializing in coordination of geophysical and geological interpretation. Hoylman holds a B.S. degree in petroleum engineering and a B.A. in geological engineering, both from the University of Pittsburgh.

During 1938-40 he did research work for Gulf Oil Corp. in ground and airborne magnetic interpretation. After World War II he was chief geophysicist for Fairchild Aerial Surveys Inc. in Los Angeles before becoming director of the Airborne Magnetometer Division. Hoylman is a member of SEG, AAPG, AIME, AGU, Seismological Society of America, The Geochemical Society, and the Aircraft Owners and Pilots Association.

in part to diurnal and in part due to errors in determining the intersections of profile and traverse lines. With no greater errors occurring, it definitely can be concluded that these data have had the diurnal correctly removed and the resultant survey definitely rated as accurate.

Contour map shows diurnals removed. Another test that might be applied to a magnetic survey is to note the type of contour map that results from this direct subtraction method of removing diurnals. If the diurnal has been correctly removed, contours should be very smooth. In Figure 7, the original contoured data are shown for a small area in northeastern British Columbia. The contour interval has been precisely determined from spotting 10-gamma intervals from respective profiles after corrections for diurnal. If the diurnal had not been completely removed, herringbone (high and low nosings) would be expected, particularly in the magnetically flat areas in the eastern part of the figure.

Since the contours are extremely smooth with no herringbone along the adjoining profile, there is further evidence of the correct removal of diurnal regardless of its magnitude and of either short or long period oscillations. With the type of diurnals indicated in the earlier figures, it would not have been possible to get such smooth contouring if any form of base loop system had been used.

Finally, if a triple-pass base loop system had been used to survey the area (Figure 7), it would have required 30 percent more linear profile miles of data. Also, the spotting and tying together of the base loops and profiles would have been very time-consuming and susceptible to human error. It therefore is less costly and less time-consuming to use the direct subtraction method of removing diurnal. The resulting high quality survey illustrates practical aspects of this new method.

LITERATURE CITED

[1] Deegan, Charles J., "Economics of Aerial Magnetics," *Oil and Gas Journal* (July 22, 1948).
[2] Brundage, H. T., "Nuclear precession magnetometer successfully field tested," WORLD OIL 148 No. 5, 127-128 (April 1959).
[3] Peters, Leo J., "The Direct Approach to Magnetic Interpretation and Its Practical Application," *Geophysics* (July 1949).
[4] Hoylman, H. W., "Evaluation of Magnetics in the Delaware Basin," WORLD OIL (August 1951).
[5] Whitham, K. and Loomer, E. I., "Irregular Magnetic Activity in Northern Canada with Special Reference to Aeromagnetic Survey Problems," *Geophysics*, 22, 646-659 (1957).
[6] Pake, George E., "Magnetic Resonance," *Scientific American*, p. 58 (August 1958).
[7] Hoylman, H. W. and Erfle, M. E., "Airborne Magnetometer Surveys Useful in the North," *Oilweek* (November 13, 1959).

New method for estimating primary oil reserves

By Dr. William F. Stevens, Associate Professor of Chemical Engineering, and
Dr. George Thodos, Chairman, Department of Chemical Engineering,
The Technological Institute, N. U., Evanston, Ill.

A DIRECT APPROACH for the estimation of primary oil reserves has been developed and applied to several sets of actual field production data.

The method consists of relating production rate to time, according to the linear relationship $q = m \ln t + k$.

Actual production data, when fitted to this equation, produce the constants m and k for a particular field. Once these constants are established, it becomes a simple matter to predict the time at which the economic limit rate will be reached. In addition, this relationship permits estimation of the additional production to be expected up to the time of abandonment.

The method has been applied to six sets of production data. In each case, the first several points were ignored and a straight line fitted to the remainder. A comparison is presented between the results obtained by this method and those reached by the method of Arps for both constant percentage and hyperbolic decline.

Primary problem. The primary problem associated with oil production is the reliable estimation of oil reserves. It would be desirable to be able to obtain such estimates before production has actually been initiated; however, this usually is not possible until some production data have been obtained. With this information, the problem becomes one of extrapolation to the economic limit.

A significant contribution to this problem has been made by Arps,[1] who has suggested three kinds of decline curves. Production data must be fitted to these curves, after which the best fit is selected and used for extrapolation to predict the time at which the economic limit will be reached.

It would be desirable to arrive at this conclusion from a single plotting of the data without the necessity for selecting between several alternatives, none of which represents the data exactly. This article presents a method that makes possible the extrapolation of available production data in a simple and straightforward manner without the need for an assumed type of decline.

MATHEMATICAL TREATMENT

The combined factors influencing pressure depletion within a reservoir are reflected in the continuous decrease of production rate with time. In addition, typical production data indicate that rate of production decrease also decreases with time. This fact suggests that rate of decrease of production rate (dq/dt) can be considered to be inversely proportional to time.

Consequently:

$$\frac{dq}{dt} = m\frac{1}{t} \qquad (1)$$

Rearranging and integrating Equation (1):

$$q = M \log t + k \qquad (2)$$

where $M = 2.303\,m$. Equation (2) cannot be applied over the entire period of operation. As t approaches zero, Equation (2) predicts that q will approach infinity, which is physically impossible. In addition, since negative values of q are meaningless, the equation is not applicable for values of t greater than that which gives $q = 0$. However, since the areas of interest lie between these two extremes, Equation (2) should prove useful for extrapolation to the economic limit.

Cumulative production up to the time of abandonment, t_a, follows directly from the fact that $q = \frac{dQ}{dt}$. Then:

$$\int_{Q_p}^{Q_a} dQ = \int_{t_p}^{t_a} q\,dt$$

where: Q_p = cumulative production up to present time, t_p.
Q_a = cumulative production up to abandonment time, t_a.

Substituting and integrating:

$$Q_a - Q_p = \int_{t_p}^{t_a} \left[m \ln t + k \right] dt$$

$$= m\left[t \ln t - t \right] + kt \Big|_{t_p}^{t_a}$$

$$= m\left[t_a \ln t_a - t_a - t_p \ln t_p + t_p \right] + k\left[t_a - t_p \right]$$

which simplifies to

$$Q_a - Q_p = m\left[t_a \ln \frac{t_a}{e} - t_p \ln \frac{t_p}{e} \right] + k\left[t_a - t_p \right] \qquad (3)$$

Equation (3) is based on the assumption that production data are representable by a smooth curve. This would be the case if instantaneous rate measurements were available.

However, production rates usually are determined as averages over an interval of time, often a month. In such cases, the production rate curve should be a series of steps rather than a smooth curve. The treatment leading to Equation (3) is approximately equivalent to drawing a smooth curve through midpoints of the steps and using it to represent the production rate data.

If the data normally obtained are used as a series of average values, each representing the production rate which existed for a month, the cumulative production up to abandonment time also can be determined by applying Equation (2) to a series of subsequent months and summing up the total monthly productions.

Therefore, the total production up to abandonment time may be represented as:

$$Q_a = \sum_{m=1}^{A} q_m = q_1 + q_2 + \ldots + q_N + q_{N+1} + \ldots + q_A$$

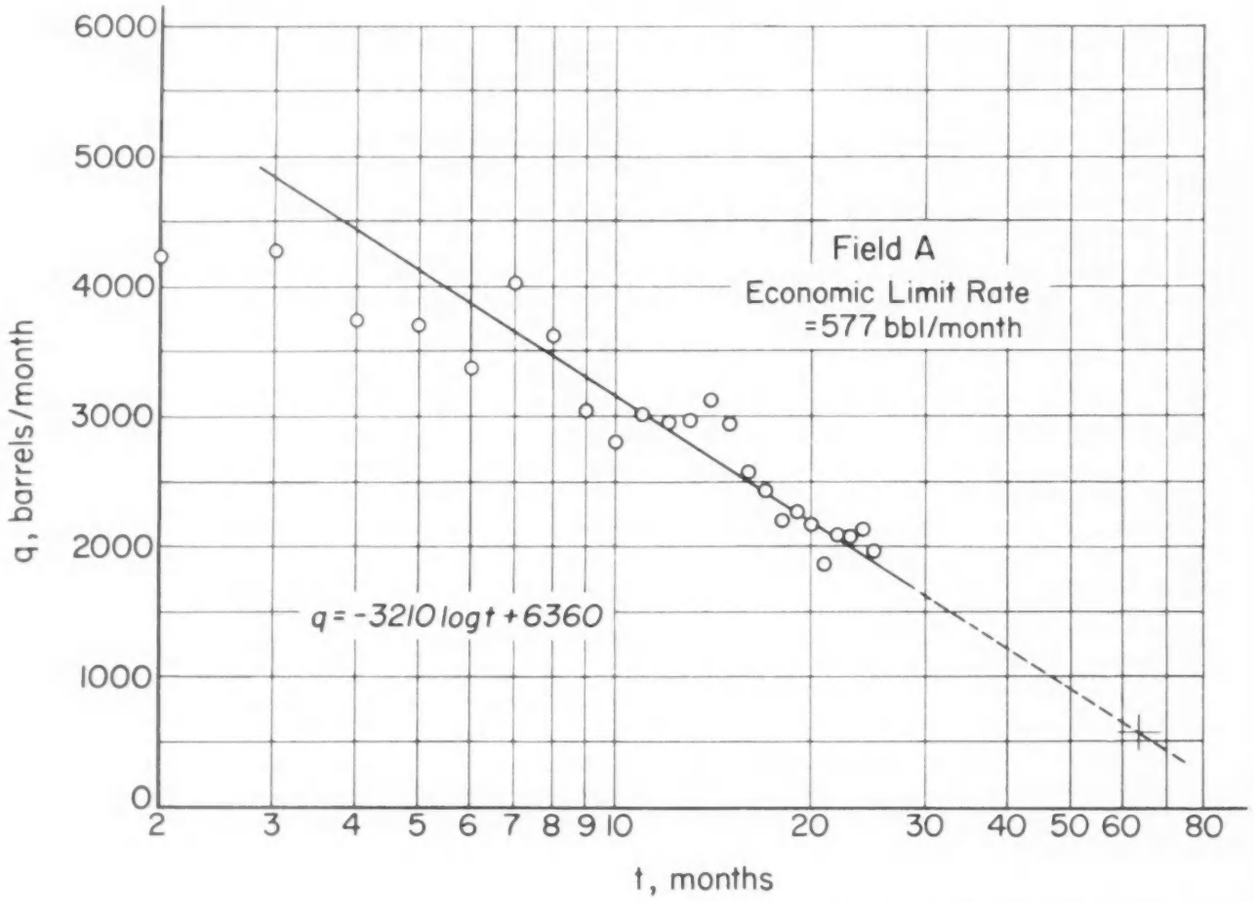


FIGURE 1—Plot of production data versus time for Field A. The best straight line is drawn through the points with the least weight placed on initial production values. Extrapolation of the line indicates that the economic limit will be reached during the 64th month.

Total production up to the present month is:

$$Q_p = q_1 + q_2 + \ldots + q_N$$

Therefore, the anticipated production from the present time to abandonment time is:

$$Q_a - Q_p = q_{N+1} + q_{N+2} + \ldots + q_A$$

Substituting values of q from Equation (2):

$$Q_a - Q_p = M \log (N+1) + k + M \log (N+2) + k + \ldots + M \log A + k$$

$$= M \log [(N+1)(N+2)\ldots (A)] + [A - N]\, k$$

$$= M \log \frac{A!}{N!} + k\,(A - N) \qquad (4)$$

where A and N must be integral values of the time in months, and are equivalent to t_a and t_p, respectively.

Equation (4) should produce results comparable to those obtained from Equation (3). It consists of summing up a finite series of rectangular areas, each one month in width, rather than determining the area under a smooth curve.

An example. The following example illustrates application of both relationships. Actual production data have been used from six different producing fields (A, B, C, D, E and F). Data for Field A have been analyzed in detail using Equations (3) and (4), and results from all six fields are summarized.

Application of Method

Production from Field A (Table 1) comprises the combined output of eight oil wells which have been in production for 25 months. The economic limit rate for this field is 577 bbl/month. Using this information, determine the time of abandonment and the additional production to be expected after the present month, using both Equations (3) and (4).

1. Plot data and draw best straight line. Production data are first plotted as q versus log t, in accordance with Equation (2). The best straight line is then drawn through the data points, by eye, putting the least weight on initial production values. This has been done for the data of Field A (Figure 1). It should be noted that these data are cyclical in nature, which makes the selection of the best straight line somewhat difficult.

2. Establish abandonment time. Extrapolation of the straight line indicates that the economic limit rate will be reached at the 64th month. That

TABLE 1—Production Data—Field A.

t, Month	q, Bbl./Mo.	t, Month	q, Bbl./Mo.	t, Month	q, Bbl./Mo.
1	3976	9	3046	17	2432
2	4231	10	2801	18	2202
3	4265	11	3008	19	2266
4	3741	12	2953	20	2176
5	3698	13	2975	21	1854
6	3370	14	3120	22	2086
7	4038	15	2946	23	2078
8	3615	16	2584	24	2127
				25	1964

TABLE 2—Comparison of Time Left Till Abandonment and Expected Production for Six Fields.

Field	METHOD OF ARPS				THIS INVESTIGATION		
	Constant Percentage Decline		Hyperbolic Decline			Additional Production, Bbl.	
	Time Months	Additional Production Bbl.	Time Months	Additional Production Bbl.	Time Months	Equation (3)	Equation (4)
A	35	38,140	51	53,955	39	43,520	42,880
B	9	2,526	17	4,842	23	6,777	6,682
C	14	5,333	40	15,694	30	12,571	12,422
D	25	8,416	60	20,372	35	12,187	12,034
E	4	2,248	11	6,598	11	6,824	6,730
F	17	2,950	21	3,661	15	2,553	2,519

is, the time of abandonment will be 39 months after the present month.

3. Determine equation of straight line. The production-time relationship for this field has been determined from Figure 1 to be

$$q = -3210 \log t + 6360$$

where

$$M = 2.303m = -3210 \text{ and } k = 6360$$

4. Calculate expected additional production. Additional production to be expected can be evaluated by means of Equation (3) or Equation (4). Using Equation (3), the calculation becomes:

$$Q_a - Q_p = 2.303m \left[t_a \log \frac{t_a}{e} - t_p \log \frac{t_p}{e} \right] + k \left[t_a - t_p \right]$$

$$= -3210 \left[64 \log \frac{64}{2.718} - 25 \log \frac{25}{2.718} \right] + 6360 \left[64 - 25 \right]$$

$$= -3210 \left[64 \log 23.55 - 25 \log 9.198 \right] + 6360 \, [39]$$

$$= -3210 \, [87.807 - 24.092] + 6360 \, [39]$$

$$= 43{,}520 \text{ bbl}$$

Anticipated additional production can also be determined with Equation (4):

$$Q_a - Q_p = M \log \frac{A!}{N!} + k \, (A - N)$$

$$= -3210 \log \frac{64!}{25!} + 6360 \, (64 - 25)$$

$$= -3210 \, (89.10342 - 25.19065) + 6360 \, (64 - 25) = 42{,}800 \text{ bbl}$$

The two equations produce slightly different results. This small difference is to be expected, since the equations were developed under somewhat different assumptions.

It should be pointed out that both equations are approximate, and it is difficult to determine which is more reliable. The results obtained from both equations have been presented for comparison.

Similar calculations have been made using production data for the other five fields. The results for the six fields are summarized in Table 2. Results also are presented for calculations in which the method of Arps[1] has been applied to the same production data. It can be seen that the new method gives results which, for the most part, lie between the values obtained from the two decline curves recommended by Arps. Hence, it appears that the proposed method gives a reasonable estimate of reserves in a direct manner, with significantly less computational effort.

ACKNOWLEDGMENT

The authors wish to acknowledge the assistance of C. H. Clark and L. J. O'Brien of the Pure Oil Company.

NOMENCLATURE

A	time of abandonment, expressed in whole months
e	base of natural logarithms, 2.718
k	intercept for Equation (2)
m	slope for Equation (2), using natural logarithms
M	slope for Equation (2), using base 10 logarithms
N	present production time, expressed in whole months
q	production rate, bbl/mo
Q	cumulative production, bbl
Q_a	cumulative production up to abandonment time, bbl
Q_p	cumulative production up to present time, bbl
t	time, months
t_a	time of abandonment, months
t_p	present production time

LITERATURE CITED

[1] Arps, J. J., "Estimation of Primary Oil Reserves," Trans. AIME, 207, 182 (1956).

About the Authors

Stevens

Thodos

William F. Stevens is an associate professor of chemical engineering at Northwestern University. He was graduated from Northwestern University with a B.S. degree in chemical engineering in 1944. After three years in the Navy, he went to Wisconsin for graduate work, receiving a Ph.D. degree in 1949. He spent two and one-half years as a research engineer with the B. F. Goodrich Company, leaving to enter the teaching profession.

His special area of interest is process dynamics, in which he is actively engaged in teaching and research. He is a member of Tau Beta Pi, Sigma Xi, Phi Lambda Upsilon, the American Chemical Society, and the American Institute of Chemical Engineers.

George Thodos, chairman of the Chemical Engineering department of Northwestern University, received B.S. and M.S. degrees from the Armour Institute of Technology, and completed his Ph.D. degree in 1943 from the University of Wisconsin. His experience includes five years with Phillips Petroleum Company and Pure Oil Company in research and development work, engineering design and technical evaluation of patent applications. Since 1947, he has been associated with the Chemical Engineering Department of Northwestern University.

He has published in excess of 50 technical papers primarily concerned with thermodynamics and transport properties of hydrocarbons. In addition, he holds seven U.S. patents. He is a member of Tau Beta Pi, Sigma Xi, Phi Lambda Upsilon, Pi Mu Epsilon, Alpha Chi Sigma, the American Chemical Society, and the American Institute of Chemical Engineers.

Modified slim hole program cuts costs

Humble saved $39,000 on six wells drilled in the Paradox Basin of Utah

By H. J. Flatt, District Engineer,
Humble Oil & Refining Company, Durango, Colo.

TODAY, AN OIL PRODUCER'S best avenue toward satisfactory profit margins lies in finding ways to increase his income and/or to reduce operating costs.

And right now, the cost reduction route appears the most promising.

Administrative, organizational and technical improvements are leading to measurable success in many companies.

But the greatest potential likely exists in technical progress.

Recognizing this, Humble Oil & Refining Company recently began an improved slim hole drilling program in Utah's Paradox Basin. Six wells drilled under this modified program led to a $39,000 savings as compared with previous slim hole operations.

The savings resulted from:

- Proper rig selection
- Larger pumps to allow optimum rig hydraulics
- Multiwell contracts
- Closer operator supervision
- Detailed drilling design procedures.

DRILLING CONDITIONS

In southeastern Utah's Aneth area, located in the Paradox Basin, Pennsylvanian tests range from 5,400 to 6,200 feet and normal drilling time varies from 30 to 40 days. Formation characteristics are similar for both pool and wildcat wells. Conventional practice consists of drilling a 7⅞ inch or 9 inch hole. Only limited use of jet bits is made. Setting depth of 8⅝ inch or 10¾ inch surface casing depends upon the erratic occurrence of a water flow at about 1,400 feet. No unusual drilling problems are encountered.

INITIAL EXPERIENCE

In this discussion, the term "slim hole" applies to relative miniaturization. For example, both 6¼ inch and 6¾ inch wells are considered "slim holes" relative to 7⅞ inch and 9 inch wells.

In a continuing effort to reduce exploratory drilling costs, Humble progressed through a modified slim hole program and an experimental rig hydraulics test. A combination of these two programs resulted in the improved slim hole technique.

Initially, a modified slim hole program was used successfully in drilling 14 exploratory wells in the Aneth area.[1] Both penetration rate and footage per bit were less favorable than comparable values measured on conventional-sized holes. Nevertheless, the experience of this project showed that savings of 5 percent were recorded on dry hole costs and 10 percent on producers.

Next, Humble conducted an experimental drilling test to measure the significance of planned rig hydraulics. On a two-well program, substantial gains in drilling performance were observed. Despite this improvement, a net savings of only $3,000 per well, or 5 percent of conventional dry hole costs, resulted.

Costs incident to improved hydraulics (i.e., higher maintenance on pumps and engines, increased fuel, and depreciation on supplemental pump liners) partially offset savings from superior bit life and penetration rate. In this case, as well as with the modified slim hole program, total cost per foot of hole was influenced heavily by factors other than bit life and penetration rate.

IMPROVED SLIM HOLE PROGRAM

After field-proving the economic merit of slim hole drilling and planned rig hydraulics in the Aneth area,

PROGRAM	
Bit Loading	
Hole Size—Inches	
Bit Weight—1000 Lbs.	
Bit Weight—Lbs./In. Diameter	
Rotary Speed—RPM	
Mud Properties	
Density—Ppg.	
Viscosity—Sec.	
Hydraulics	
Pump Pressure—psig	
Circulation Rate—GPM	
Pump Output HP	
Bit Hydraulic HP	
Range of Annular Velocity-fpm [1]	
PERFORMANCE	
Average Ft./Bit	
Average Ft./Hr.	

Humble combined both techniques into an improved slim hole program. Seven wells were drilled. Since a nonrepresentative fishing job was experienced on one hole, it was excluded from project summaries to reflect a more reliable picture of program economics.

The six dry holes were grouped into three areas to account for varied drilling conditions. Area II is characterized by hard drilling. For each of these areas, the best previous experience was combined to represent a composite well for comparison with the improved slim holes. Actual costs for each slim hole were related to estimated conventional costs for similar wells.

Equipment. Success in any development effort always requires proper equipment and experienced crews. In the combined slim hole and hydraulics program, this basic principle was especially true. Typically, some difficulty was experienced before these needs were satisfied.

Most operators have this problem. This is particularly true where only a few wells are drilled in sequence. Less difficulty is expected in future operations due to the progress many contractors have demonstrated in assembling ideal slim hole rigs.[2]

Several equipment factors were of special benefit on the Humble program. A pair of small, mobile rigs, selected to operate at capacity depth, minimized time and expense of moving and rigging. Large pumps necessary to allow optimum rig hydraulics were installed. Multiwell contracts were let and full operator supervision, including responsibility for the hole and equipment, was assumed. All operations followed detailed design procedures.

Results. The chart below summarizes comparative programs, performance and costs for the six wells in the improved slim hole program. Performance data were compared by finding averages through the same geologic interval—from the surface casing shoe to the top of the pay zone.

Resultant bit lives and penetration rates were essentially equal to those of larger holes. This represented a substantial improvement over the performance of previous slim holes which were drilled without the benefit of optimum hydraulics. For example, performance data on one of the 14 wells drilled in the modified slim hole program are set out under Area II. As shown, a poor penetration rate was associated with low bit hydraulic horsepower. It is also interesting to note that on well A, bit hydraulic horsepower was increased three times over conventional values with only 14 percent more output horsepower from the pump.

ole program cut costs and improved performance . . .

	AREA I			AREA II				AREA III		
	Well A	Well B	Previous Average	Well C	Well D	Well E	Previous Average	Modified Slim Hole	Well F	Previous Average
	6¼	6¼	7⅞	6¾	6¼	6¼	9	6¾	6¾	7⅞
	28	29	42	35	32	33	36	28	39	45
	4500	4600	5300	5200	5100	5300	4000	4100	5800	5700
	68	67	67	85	62	71	65	75	71	90
	9.2	9.4	10.0	9.1	9.3	9.3	9.7	9.7	9.3	9.4
	36	38	37	34	37	40	38	40	34	36
	1640	1490	670	1765	1700	1350	802	894	2250	1274
	210	201	440	222	206	212	394	290	201	298
	205	177	180	229	204	166	185	151	264	222
(1)	165	116	55	137	129	97	38	14	200	146
	21-313	20-299	36-545	20-357	20-306	21-316	28-303	27-466	18-323	24-370
	131	117	142	128	91	100	103	94	146	109
	16.6	13.2	13.8	13.8	11.5	9.1	11.1	7.5	14.8	16.7
	$68,200	$60,100	$67,200	$72,600	$69,600	$74,500	$78,300	$73,900	$67,200	$72,200
	$10.47	$9.77	$11.45	$12.44	$12.10	$12.95	$13.55	$12.68	$12.28	$13.20

(1) Based upon: Minimum—drill pipe in washout section 10 inch over gage; Maximum—drill collars in gage hole.

The improved slim hole program proved a successful cost reduction measure with one exception. On the last well in the program, unusually difficult fishing problems resulted in abnormally high costs. These costs were excluded, however, to reflect a more realistic economic status of the project. That the wells were slim holes definitely contributed to the severity of the fishing job—yet this trouble should be prorated over a much larger number of wells to be consistent with the probability of occurrence.[3]

As with numerous other reports,[1,2,3] savings stemmed primarily from reduced drilling costs; that is, daywork, bits and accessory charges were less than existing footage rates in the area. Minor additional savings accrued from lower mud, cement and cementing service costs. Further savings stemmed from reductions in the size of surface casing.

Application. Some confusion exists within the industry over the performance and cost data being published. Occasionally, an operator or contractor will report that slim holes and/or optimum hydraulics actually cost more than conventional practices.

Two well known facts stand out in drilling operations: bit weight has a major influence on penetration rate, and adequate cleaning of the bit is necessary to utilize applied weight.

Despite the excellent work being carried on towards increasing load capabilities of small bits, the fact remains that load capacity decreases with bit size. Therefore, hard drilling conditions often reverse slim hole gains.

Furthermore, the efficiency of rig hydraulics is discussed rarely when comparing different drilling techniques. As shown in this report, bit cleaning plays a critical role in drilling performance.

From the foregoing, it is clear how different operators may experience varying results. It is important, therefore, that formation hardness, hole size and hydraulics be considered together in performance studies. These factors exert a decisive influence on the total cost per foot of hole drilled.

In general, costs can be reduced by following two simple alternatives:

1. With soft drilling, slim hole techniques accompanied by large pumps are normally profitable.
2. Hard drilling usually calls for larger bits and less pump.

These statements disregard many other relevant items, but they do emphasize the key factors of rock drillability, hole size and pump.

Limitations. Although slim hole drilling practices and the related technique of tubingless completions have proved effective cost reduction measures in numerous cases, they are subject to definite limitations. The problems inherent in these programs fall into three general categories: drilling, completion and production.

Slim hole limitations in the drilling category can be further sub-divided into two groups. The first of these, formation limitations, includes such factors as unknown formation characteristics, depth requirements and conditions of hard drilling. The second group includes mechanical difficulties, especially fishing problems, which may be encountered.

Completion limitations include such factors as reduced equipment performance, limited tool availability and working room problems.

Several limitations occur in the producing category when tubingless completions are employed on slim holes. It is infrequent that high gas-oil ratio fluids are pumped with a reasonable degree of efficiency. Lack of an annulus restricts optimum downhole treatment for scale and corrosion where, for physical or economic reasons, hollow sucker rods may be justified. Consideration must also be given to the possibility of multi-zone completions and secondary recovery operations.

About the Author

H. J. Flatt joined The Carter Oil Company in 1952 after graduating from the University of Colorado with a B.S. degree in civil engineering. Recently, Carter was merged with Humble Oil & Refining Company. Flatt is district engineer in Durango, Col.

ACKNOWLEDGMENT

The author wishes to express appreciation to Humble Oil & Refining Company for the necessary time and facilities to prepare this report. Furthermore, contributions by other members of the Humble organization were instrumental to the content of this paper.

LITERATURE CITED

[1] Flatt, H. J. "Slim Hole Drilling Decreases Carter's Development Costs," *Journal of Petroleum Technology*, July, 1959, Vol. XI, No. 7, p. 19.

[2] Aggers, B. A. "A Practical Look at Slim Hole Drilling." *The Petroleum Engineer*, November, 1960, Vol. 32, No. 12, p. B-34.

[3] Frederick, Robert O. "Technology's Answer to an Economic Need," *Drilling Magazine*, August, 1960, Vol. 21, No. 11, p. 49.

Use one bolt to hold cleanout plate in place on the mud tank

When emptying the mud from the mud tanks, it is only necessary to remove one bolt and the cover is then open, easily removing the mud from the tank. The plate is sealed in with a soft gasket while the levers on the sides are used to wedge in the plate. Final tightening is accomplished with the bolt in the center.

The cleanout plate is set into the box and welded into the side of the tank. A handle is then welded to the face of the plate and is used to hold the plate while the center bolt is made-up snug.

At Nominal Cost To You
WORLD OIL'S Drilling And Production Library

To receive your personal copies of these practical books, just indicate on the order form the ones you desire. Then mail the form to Reprint Dept., WORLD OIL, P. O. Box 2608, Houston 1, Texas.

If you aren't subscribing to WORLD OIL, we'll send you—at no extra cost—your choice of one of the books . . . as an inducement to have you as a subscriber.

Just tell us to enter your subscription, for what period, check the book you want as a Bonus Offer . . . then fill in the remainder of the form and mail it to us. Better hurry—copies of the books are limited.

PRODUCING EQUIPMENT FOR NATURAL GAS WELLS

Used by hundreds of key oil men, this manual can be of real interest and value to you.

Areas covered in 10 Chapters include: Oil and Gas Separator. Three-phase Separator. Low Temperature Separation Unit. Long Cycle Dry Desiccant Dehydrator. Calcium Chloride Gas Dehydrator. Glycol Dehydrator. Short Cycle Hydrocarbon Recovery Unit. Absorption Refrigeration Unit. Indirect Line Heater. Field Instrumentation and Control of Oil and Gas Producing Equipment.

72 pages, 33 illus., 87 figures. **$1.00**

CURRENT FISHING TOOLS AND TECHNIQUES

This manual is the result of 12 months of extensive effort by key oil men. Contents include: Fishing in Cased Holes—recovery of liners, production packers, tubing, rods, wireline tools. Open Hole Fishing Tools and Methods—recovery of drill pipe, drill collars, twist-off pipe, small objects, miscellaneous wireline tools.

40 pages, 52 figures. **Price $1.00**

CARE AND MAINTENANCE OF TOOL JOINTS

When drill string problems occur, they generally are expensive, resulting in fishing jobs or expenditures of funds for repairs. This manual is not intended as a technical approach for engineers only. It is designed to benefit all personnel interested in obtaining the best possible performance from drilling strings. It provides discussions on the majority of more common problems encountered in the field, and is the most complete coverage of this important subject published in recent years.

24 pages, 57 figures. **Price $1.00**

DRILLING NOTEBOOK

Provides over 130 short-cut drilling ideas, such as: How to protect drilling line easily. How magnetic fishing tool saves time and money. How to cut rig up time. How to handle blowout preventers easily. How to save lost time in moving pipe. How to adjust belt tensions with drill pipe. How central chemical pump installation saves time. How to improvise transfer ramp. How to expedite core handling. How to handle high loads easily.

40 pages, 135 illus. **Price $1.00**

PRODUCTION NOTEBOOK

You have over 120 top-notch production ideas, such as: How to remove casing pressure during fill up. How pumping unit scaffold increases safety on job. How vent riser prevents oil pollution. How to inject inhibitor into casing. How to test separator relief valve from ground. How to make wellhead maintenance convenient. How to reduce tank fire hazard. How color code simplifies test unit hookup.

40 pages, 124 illus. **Price $1.00**

To order fill in order form below and mail to us today.

Reprint Dept., WORLD OIL, P. O. Box 2608,
Houston 1, Texas
Send me at $1.00 a copy:

_____ cps Producing Equipment For Natural Gas Wells

_____ cps Current Fishing Tools & Techniques

_____ cps Care & Maintenance Of Tool Joints

_____ cps Production Notebook

_____ cps Drilling Notebook

☐ Bill me ☐ Bill my Co. ☐ Payment enclosed

* * * *

Enter my subscription to WORLD OIL for:

☐ 1 year, $2 ☐ 2 years, $3 ☐ 3 years, $4

☐ Bill me ☐ Bill my Co. ☐ Payment enclosed

Send as Bonus Offer my choice of one:

☐ Producing Equipment For Natural Gas Wells
☐ Current Fishing Tools and Techniques
☐ Care & Maintenance of Tool Joints
☐ Drilling Notebook ☐ Production Notebook

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Please check division(s) of industry:

☐ Production Company ☐ Exploration Company
☐ Drilling Contractor ☐ Consulting Engineer
☐ Independent Producer ☐ Consulting Geologist

Add 2% Sales Tax on orders originating in Texas.

In Texas, Oklahoma, Kansas, Colorado, Panhandle area . . .

Merging fields may create nation's No. 2 gas reserve

New oil and gas discoveries, plus merging of adjacent fields is creating a "new field" concept for this prolific four-state area

By Curtis Stevens, Editor
National Petroleum Bibliography, Amarillo, Texas

LITTLE APPARENT among the reports and statistics of four different states is the tremendous exploration and development campaign which only now is beginning to prove up what ultimately should be the nation's No. 2 gas reserve—the "new field" Panhandle area of Texas, Oklahoma, southwest Kansas and southeast Colorado.

In a series of production chains extending from Baca County, Colorado, to Ellis County, Oklahoma are located gas reserves estimated in excess of 10 trillion cubic feet.

More than a hundred rotary rigs are at work in an area 160 miles long and up to 100 miles wide, continually opening new areas for development and extending and merging older producing sectors.

Multiple pay horizons are the rule in nearly every field, with as many as seven different pay zones found in some fields.

Even the wildcat success ratio is outstanding, varying from area to area by states, but rarely dropping below 30 per cent overall.

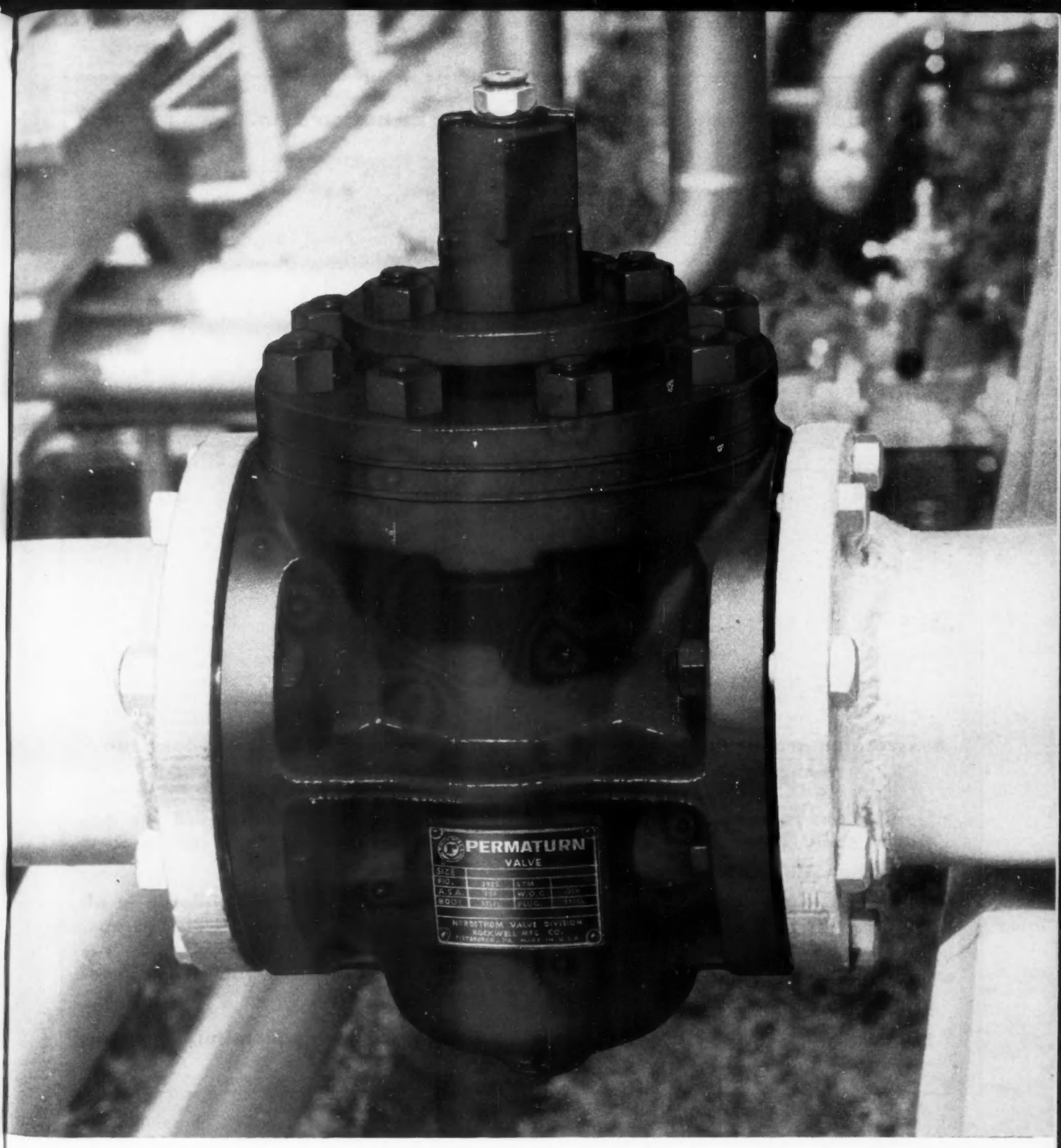
Located in the same geological province with the old Hugoton-Panhandle field, the world's greatest natural gas reservoir, and in fact bisecting that field at deeper levels, the new development has drawn much attention as to local producing areas, but little overall treatment. Such treatment has been hindered not only by the great size and complexity of the area, but by the political boundaries involved. Few companies operate in every part of this four-state region, district boundaries generally broken at the Texas-Oklahoma or Oklahoma-Kansas line. Even fewer individuals have the time or data necessary to document such a study.

Yet the steady growth of oil and gas fields, plus the merging of adjacent field areas, is gradually forcing the recognition of a new "field" concept for the entire area—a concept of multi-level, interlayered stratigraphic traps joining into chains of impressive length. In the entire 200-mile distance from Baca County to Ellis County, for example, there is no producing area located farther than six miles from its closest neighbor. And the gaps steadily are being closed.

Area development. Illustrative is a sector of Ochiltree County, Texas, which in 1959 had fewer than a score of wells. A drilling program launched by Shamrock Oil & Gas Corporation at that time opened the Ellis Ranch area, which has grown by additional discoveries and extensions to include an area of some 75 sections underlain by seven different pay horizons. Continuous production extends from the Lipscomb County line westward to the Farnsworth field, a distance of 22 miles.

Last year saw a Topeka discovery by Horizon Oil & Gas Company completed in Baca County, Colorado, seven miles west of nearest Greenwood field production. This year the firm has linked that discovery area with Greenwood, and has in addition opened up a new field six miles farther northwest, with production already established between the two newest fields. Pan American has had much the same success in northwest Oklahoma, as has Cities Service in southwest Kansas.

In 1950, however, the province was barely productive outside the bulk of the Panhandle-Hugoton field. In the Texas Panhandle were the Lips and Cator-Palo Duro Creek areas, plus two one-well fields in Ochiltree County. Northwestern Oklahoma had three producing areas in Keyes, Lib-



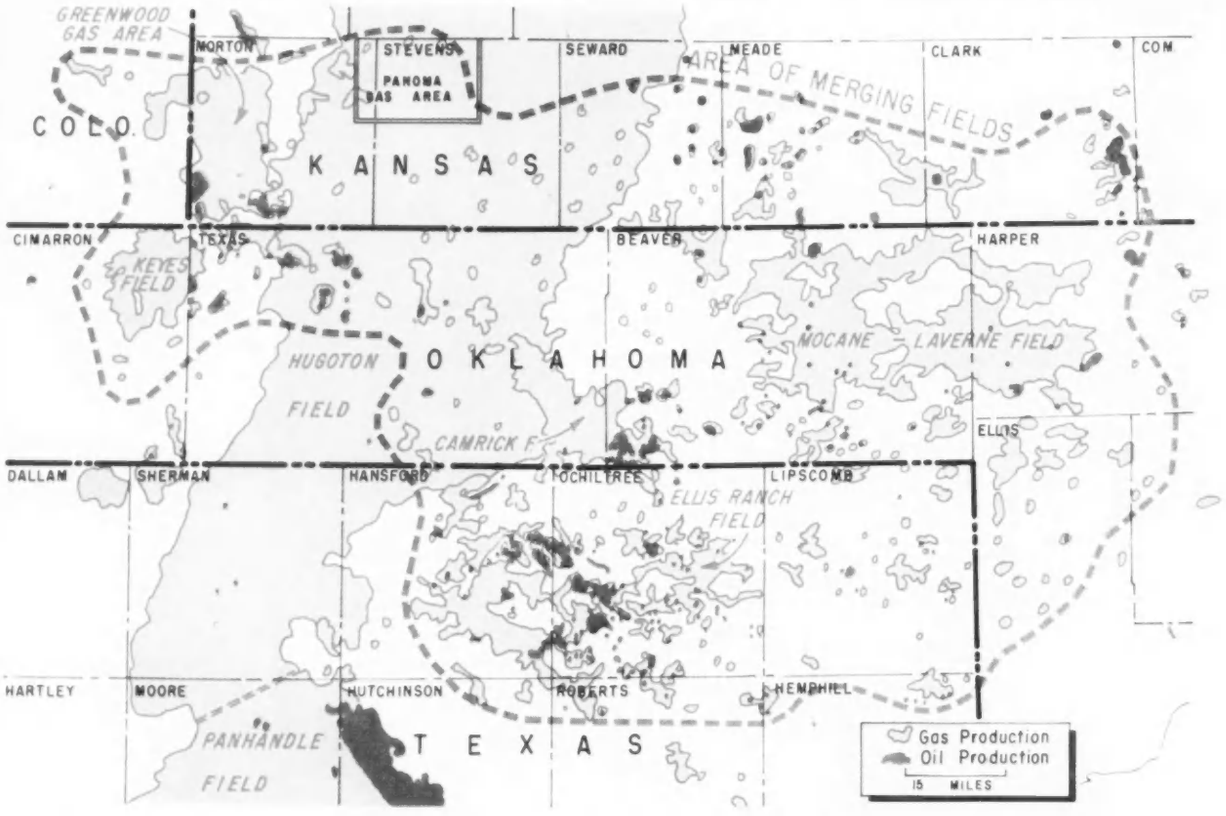
PERMATURN* VALVES • **so new, we changed their colors, too.** You'll find the new PERMATURN semi-steel valves bright red: a color just as bold as the design concept they represent. For Rockwell PERMATURN valves were designed to incorporate all the most-wanted valve features: to give you new valve versatility for easy services or tough ones. Steel PERMATURN valves are now gray and offer new standards of valve performance in the higher pressure services.

To learn more about this exciting new valve line, write to Rockwell Manufacturing Company, 400 N. Lexington Avenue, Pittsburgh 8, Pennsylvania for a copy of the new Pocket Valve Guide.

PERMATURN VALVES
another fine product by
ROCKWELL

*Trademark Rockwell Manufacturing Company

"New field" Panhandle area may ultimately be nation's No. 2 gas reserve



Boxscore on prolific Panhandle area of Texas, Oklahoma, Kansas, and Colorado

(160 miles long and 80 miles wide)

- **Natural gas reserves estimated at 10 trillion cubic feet.**
- **More than 100 rotary rigs now operating.**
- **Multiple pays are the rule, with as many as seven zones in some areas.**
- **Wildcat success ratio rarely drops below 30 percent.**
- **During first 10 months of 1961, there were 31 abandoned dry holes re-entered, with 13 recompleted for gas and 4 for oil—a 55 percent success ratio.**
- **Open acreage still is available in all but the most heavily drilled areas. Top price is $35 in many active regions, though often subject to override.**
- **Farmouts still are plentiful, but terms are stiff.**

eral-Light and Laverne fields. A total of seven fields were located in southwest Kansas, the most important being Adams Ranch, Southeast Liberal, Richfield and McKinney. Southeast Colorado had no production at all.

Today more than 300 field names may be counted on regional maps, including such giants as Greenwood, Keyes, Camrick, Mocane-Laverne and Hansford-Ellis Ranch. Probably one-quarter again as many field names have been dropped due to combination of producing areas. The conversion from dryhole wasteland to prolific gas province has been accomplished by relatively few companies working patiently from cumulative data.

This data was gained at great expense during the early history of development, for so little was known of regional production characteristics that many dry holes were drilled in what later proved to be extensive oil and gas fields. Not until 1954, when exploration and completion techniques began to accurately define the important productive horizons, did the province show a favorable balance of production income over exploration and development expense.

Even yet it is difficult to determine well productivity. During the first 10 months of 1961 there were 31 abandoned dry holes re-entered over the area, 13 recompleted for gas and four for oil, a success ratio of 55 per cent. Re-entry open-flow potentials

Announcement

The following announcement is made by virtue of the powers vested in the Ministry of Finance by Order No. 1 of 1943, as amended.

1. The areas situated within the boundaries of District 1 and District 2 as described below are declared as "open" for the submission of proposals for the award of petroleum concessions therein for a period of three (3) months from 5th Dec., 1961 ("zero date").

2. (a) Boundaries of District 1:

Commencing at the intersection of latitude 16° North and longitude 41° 20′ East; thence South along longitude 41° 20′ East in a straight line to the intersection of latitude 14° 45′ North and longitude 41° 20′ East; thence West along latitude 14° 45′ North to the intersection of latitude 14° 45′ North and longitude 40° East; thence in a North-Westerly direction in a straight line to the intersection of latitude 15° 35′ North and longitude 39° 15′ East; thence in a North-North-Westerly direction to the intersection of latitude 16° North and longitude 39° 05′ East; thence East along latitude 16° North to the point of origin, the area enclosed in said boundaries being approximately 27,500 square kilometers in area.

(b) Boundaries of District 2:

Commencing at the intersection of latitude 18° 10′ North and longitude 38° 45′ East; thence in a South-South-Easterly direction to the intersection of latitude 17° 12′ North and longitude 39° 14′ East; thence East along latitude 17° 12′ North to the intersection of latitude 17° 12′ North and longitude 39° 41′ East; thence South-East in a straight line to the intersection of latitude 16° North and longitude 41° 20′ East; thence West along latitude 16° North to the intersection of latitude 16° North and longitude 39° 05′ East; thence North-North-Westerly in a straight line to the intersection of latitude 17° 30′ North and longitude 38° 40′ East; thence North-North-Westerly in a straight line to the border between the Empire of Ethiopia and the Republic of Sudan; thence along said border to the coast of the Red Sea; thence in a North-Easterly direction in a straight line to the point of origin; the area enclosed in said boundaries being approximately 27,000 square kilometers in area.

3. Any company ("applicant company") desiring to submit a proposal or proposals looking to the award of a concession covering either or both of the Districts described above shall notify the Ministry of Mines in writing. Upon said notification, and against payment of U. S. $1,000 for each District with respect to which requested, the applicant company shall be furnished with all documents required to permit the preparation of a proposal, including a form of contract of Concession, and instructions relating to the procedure to be followed in submitting proposals, and other documents. In addition, information as to exploration activities already carried on within each such District shall be made available to the applicant company.

4. Prior to ("zero date plus three months") proposals may be filed by the applicant company in accordance with the prescribed procedure. All proposals filed before (above date) shall be deemed to be filed simultaneously but shall not, however, create or vest any right in the applicant company, the Imperial Ethiopian Government reserving full right to reject any and all proposals received without cause.

5. All proposals shall be opened in public on ("zero date plus three months and one day").

Address:

MINISTRY OF MINES
P. O. Box 486
Addis Ababa
Ethiopia.

MINISTRY OF MINES
Imperial Ethiopian Government

NOW
MORE DRILLING INFORMATION

THE MODELS G7PW OR G7TW RECORDER

These models of the Geograph Recorder were developed particularly for the contractors and operators desiring more detailed, recorded data concerning the four drilling variables—Rate of Penetration, Drilling Weight, Pump Pressure and Torque. This information is required to compete in today's highly competitive drilling situation.

Geologists obtain more information about rate of penetration and sub-surface formations and toolpushers are supplied with the information necessary to determine the optimum drilling rate for a particular formation.

Engineers and contractors can readily interpret the recordings of weight on bit, pump pressure (or torque), downtime, rate of penetration, tightspots and bit wear in making accurate decisions regarding existing drilling conditions.

The result: more hole per dollar.

When you drill your next well, specify the Model G7PW or G7TW Recorder. For additional information, ask for Catalog No. 220, or call your nearby Geograph Oil Field Services office.

GEOLOGRAPH
OIL FIELD SERVICES
P. O. Box 1276
Oklahoma City 1, Okla.

ranged from 1.2 to 6.03 MMcf gas per day, while oil wells were gaged from 90 to 216 barrels per day.

Producing formations. Complexity of the province has resulted from continued sedimentation in a long-lived marine environment marked by advancing and receding seas.

Extending into early Permian time, the deposition of marine sediments was influenced by formation of a deep basinal trough, the Anadarko Basin, and subsidiary shelf areas in the Hugoton Embayment and northwest Oklahoma Platforms. Erosional surfaces, shoreline and bar-sand deposits, and seaward carbonate buildups all affected accumulation of hydrocarbons. The stratigraphic-type reservoirs have been affected to some degree by nosing conditions caused by gentle folding of area formations, very few faults as yet positively identified.

Structural features other than these, however, appear to have little effect on accumulation of oil and gas. Porosity pinchouts and facies-changes are the major trapping mechanisms. Pressures are low for the depths involved, a peculiarity which as yet has received no generally acceptable explanation, yet pressure decline may be extraordinarily slow.

Producing levels range from 2,600 feet in the Greenwood field to 11,000 feet in the South Goodwin area of Oklahoma, with majority of completions made in the 5,000 to 8,000 foot range. Oil and gas is found almost the full length of the sedimentary column, but Permian, Pennsylvanian and Mississippian production is predominant. The many formations of Pennsylvanian age are the most important in the "new fields" area, though Permian is most important area-wide due to accumulation in the Hugoton-Panhandle field. Most Mississippian production is derived from Chester, with Siluro-Devonian and Ordovician production being almost negligible.

Primary drilling objectives vary over the length of the "new field" production, only the Morrow sands producing over the entire region. Major pays in the Texas Panhandle are Tonkawa, Cleveland, Des Moines and Morrow, with Hoover, Tonkawa, Morrow and Chester most important in northwest Oklahoma. Topeka, Morrow and Chester are main objectives in southwest Kansas, with only the former two of significance in southeast Colorado.

Drilling and completion practices. Detection of productive formations is the most important aspect of regional drilling operations, lack of oil and gas shows one of the greatest problems faced by operators in all four states. Mud logging, sample logging, and various electric and radioactivity logs may indicate production in otherwise "dry" holes, but decision to set casing on such a well can be arduous, calling for "sheer nerve" in the words of one district geologist.

Rotary rigs do most area drilling, cable-tools sometimes used in drilling-in operations and as completion units. Mud is the main circulating medium, though gas circulation is employed in certain gas producing areas of limited depth. Casing programs call for fresh water protection, surface string set through Permian redbeds, and long string is generally set through producing formation and perforated selectively. Intermediate casing string is variable with operator and depth. Medium to heavy fracture treatment is given almost all sandstone and some carbonate completions, some limestones and dolomites responding well to acid treatment in concentrations up to 15 per cent.

Many permanent-type completions, using 2⅞-inch tubing, have been made in the area within the past three years, particularly in the Texas Panhandle, with quite good results thus far. Dual completions are widespread, and a number of triple completions have been made in the Mocane-Laverne field area of Oklahoma.

Reserves and economics. Reserves of area wells and fields, though still the subject of controversy among geologists and engineers, are beginning to belie many of the earlier pessimistic predictions, with substantial recoveries already tallied in some fields.

The Light field of Beaver County, Oklahoma, one of the earliest developed and connected Morrow sand fields, has produced 68.7 billion cubic feet of gas from a total of 25 wells, an average of nearly 2.7 billion per well, with 1960 production amounting to 2.8 billion. The Lips Morrow field of Ochiltree and Roberts counties, Texas, with a total of 23 gas wells, has produced 56 billion cubic feet of gas since 1955, an average of 2.43 billion per well. Production in 1960 was 8.7 billion.

Reserve estimates reported to the

Oklahoma Corporation Commission also indicate good economic return. Estimates on 14 Morrow sand wells, predominantly discovery wells, averaged out at 4.835 billion cubic feet each, which, on an area price basis of 17 cents per Mcf, would yield gross return of $821,950. Estimates on nine Chester wells, also predominantly discoveries, averaged 2.65 billion each for gross income of $450,500. Net income is subject to variables of well cost, rarely exceeding $150,000, and operating costs which run less than $100 per month. Since the majority of wells in the area are less than five years old, and have been connected for even a lesser period of time, few representative performance records are available.

Natural gas pipe line connections, however, are perhaps better than in other areas due to the long-established Hugoton-Panhandle network, more recently supplemented by other major systems. Nine trunklines originate in this region, carrying gas to almost every part of the nation. Gathering systems are extensively developed, few fields presently unconnected and almost no sector out of reach of lateral service.

Though now more in the development rather than exploratory stage, the province still has a long way to go before activity slows down. Open acreage still is available in all but the most heavily-drilled regions, and $35.00 per acre is a top price in many active areas, though often subject to override.

Leasing campaigns still break out in fringe areas on occasion, the most recent being that in northern Wheeler County, Texas, in the deepest part of the Anadarko Basin. Farmouts, with stiffer terms and less acreage earned per test, still are plentiful.

Most often-voiced complaint among those operating, or planning to operate, here is that "every well's a wildcat." But with high success ratios, multiple pays, immense producing areas, and good payout prospects, the province offers one of the best hunting grounds on the continent.—**The End**

ERRATUM

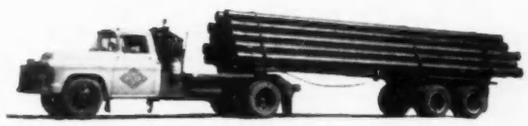
The subhead, "Clarification of anti-labor policies" which appeared on Page 19 of November WORLD OIL, should have read "Clarification of anti-trust policies.

Congrats and $25.00 to Charles L. Mizer, 114 Lexington Ave., Taft, Calif.

Tough, tested and ready to roll . . . that's the story in a nutshell on Lone Star casing, tubing and line pipe. Tough, because it's made of quality steel by men who know the needs of the oil country. Tested so carefully that every length of pipe meets or exceeds API requirements before it leaves our plant. And because we're located in the heart of the Mid-Continent producing area, Lone Star pipe can usually be on-the-job at your well site overnight.

Men in the saddle in the oil business know that Lone Star pipe is *dependable*.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.



©1956 Lone Star Steel Company

Lone Star STEEL

COMPANY

EXECUTIVE—SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas
DISTRICT SALES OFFICES
912 Republic National Bank Building, Dallas, Texas
Houston, Texas | Midland, Texas | Tulsa, Oklahoma

CALL

MID-CONTINENT

FOR

ROTARY TABLES

SURE SERVICE — SURE SUPPLY

MC1-1

MID-CONTINENT SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Mid-Continent Building, Fort Worth, Texas
Export Division: 45 Rockefeller Plaza, New York 20, N.Y. Cable: MIDCUMPORT NYK

Men in the industry

A. L. Nickerson

H. Willetts

O. N. Miller

L. E. Elkins

Albert L. Nickerson, president of **Socony Mobil Oil Company, Inc.** since 1955 and chief executive officer since 1958, has been elected chairman of the board of directors, succeeding **Fred W. Bartlett,** who has retired. **Herbert Willetts,** president of Mobil Oil Company Division, has been elected president. **Fred H. Moore,** who will succeed Willetts as president, has also been elected a member of the board of directors and an executive vice president of Socony Mobil.

Otte N. Miller has been elected president of **Standard Oil Company of Calif.** Miller succeeds **T. S. Peterson,** who has retired.

Lloyd E. Elkins, production research director for **Pan American Petroleum Corp.,** Tulsa, will become president in February of the American Institute of Mining, Metallurgical and Petroleum Engineers.

G. R. Preston, Bartlesville, has been elected a vice president of **Cities Service Petroleum Company.** He was elected a director and treasurer in 1960, and will continue in these capacities.

Mack C. Colt, Iola, Kan., has been elected president of the **Eastern Kansas Oil & Gas Association.** He succeeds **C. L. Sheedy** of Yates Center. Other newly elected officers include **George Sauder,** Emporia, vice president for northern Kansas; **R. L. Mendenhall, Jr.,** vice president for southeastern Kansas. **Edd Noland,** Chanute, was named secretary and **Carl Pate,** Chanute, treasurer.

Perry Blanton is the new chairman of the **Federal Petroleum Board,** Kilgore, Texas. He succeeds **Dan Purvis,** who had held the post since last April 1.

C. E. Brehm, independent producer in Illinois for the past 20 years, has expanded operations into the Rocky Mountain area. He has opened an exploration and production office at Casper, Wyo., and an accounting office in Denver, Colo. Brehm recently discovered the North Beaver field in Big Horn County, Wyoming.

Fred H. Brinkman of the **Jersey Production Company,** Tulsa, has been named 1961 recipient of the Cedric K. Ferguson medal, awarded by the **Society of Petroleum Engineers.** Brinkman was chosen to receive the medal because of the outstanding paper he authored on reservoir studies.

H. E. Repp, geologist at Fort Smith, Ark., for **Humble Oil & Refining Company,** has been transferred to Tulsa as central area representative.

David R. Pefley, formerly with **Humble Oil & Refining Company,** has joined the geological staff of **Colorado Oil and Gas Company** in Denver, Colo.

Harold Mosher, geologist at Casper, Wyo., for **Sunray Mid-Continent Oil Company,** has been transferred from the firm's Rocky Mountain division office to the Rocky Mountain division office at Denver, Colo.

G. A. Howard has been named manager of **Geophysical Service, Incorporated's** newly formed eastern operations office.

D. M. Putman has been elected district representative from the Ardmore district for the **Ardmore, Oklahoma, Geological Society.** He succeeds **Dan Nisley,** resigned.

George Frankel, partner in the firm of **Frank and George Frankel Oil Producers,** will serve as chairman of the Petroleum Division during the Greater New York USO's 1961 campaign to raise funds to expand USO activities.

B. S. Elliott, drilling foreman for **Sunray Mid-Continent Oil Company,** Odessa, Texas, has been transferred to Abilene, Texas, in the same capacity.

T. H. Kerlin has been appointed vice president of **Rayna Drilling Company.** Formerly with **Tradewinds Drilling Company,** Kerlin will headquarter in Tulsa, Okla. Rayna recently acquired rotary rigs operated by Tradewinds in the Mid-Continent area.

B. A. Tuller has been named district geophysicist in **Pan American Petroleum Corporation's** Casper, Wyo., office. He previously was a consulting geophysicist for Pan American. He succeeds **George L. Ellis,** who has been transferred to Midland, Texas.

Longer life and smoother starts with ROCKFORD POWER TAKE-OFFS

TAKE-OFFS Rockford's positive-lock adjusting ring provides for extremely close wear adjustment. This close adjustment feature prevents excessive engagement wear and gives smooth starts. Simply remove nameplate, release lock and turn adjusting ring to exact engaging position. No special tools are needed. Precision-built gear tooth drive clutches pull full rated torque loads during entire service life. Rockford low-maintenance PTO's transmit power from internal combustion engines to your working oil field equipment. Torque loads from 125 to 3,000 lb. ft.
Write today for illustrated brochure.

ROCKFORD
POWER TAKE-OFF

ROCKFORD CLUTCH

1237 WINDSOR ROAD, ROCKFORD, ILLINOIS

Export Sales Borg-Warner International • 36 So. Wabash, Chicago, Ill.

ROCKFORD B-W CLUTCH DIVISION OF BORG-WARNER

For more data on advertised products, use cards, last page.

RECTORSEAL #5
Scientifically compounded for better sealing

Use a compound that has been developed especially for the oil industry . . . Rectorseal #5. It is your best assurance of leakproof connections on casing, tubing, flow lines, wellheads, heater, treater, separator, tank and other oil field installations. Best also on your secondary recovery piping and LPG underground storage facilities—it's insoluble in LP gas.

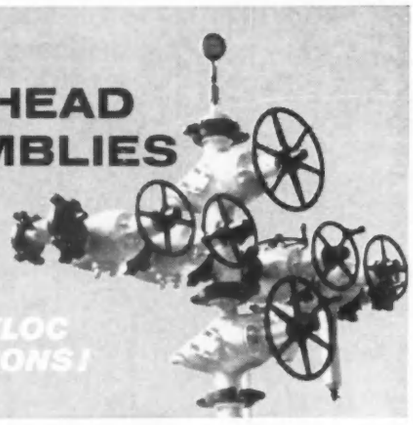
Rectorseal #5 dopes more joints per dollar, is easier to apply and lasts longer. It will not skin over, dry out, harden or settle out in the open can.

Ask for it at your Supply Store. Available in 5 gal., one gal., quarts, pints, half-pints and quarter-pints.

RECTORSEAL • **2215 COMMERCE ST.**
Dept. G **HOUSTON 2, TEXAS**

RECTORSEAL #5
THE POSITIVE LEAK PREVENTER

GRAY WELLHEAD ASSEMBLIES
are lighter, stronger, better with GRAYLOC CONNECTIONS!



Compare Grayloc wellhead assemblies with equally rated assemblies using flanged connections. You'll find the Grayloc assembly smaller, lighter and easier to nipple up; resulting in great savings in time and labor costs. Grayloc affords the ultimate in blow-out protection and safety. Let Gray demonstrate the space saving, weight saving and money saving advantages of Grayloc wellhead assemblies. Write now for full details.

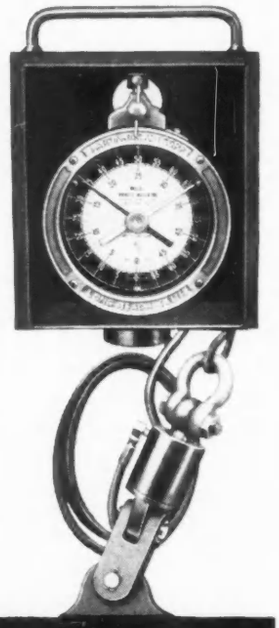
GRAY *Tool Company*

P. O. BOX 2291 • HOUSTON 1, TEXAS • RIverside 7-1240

6120

MIDGET WEIGHT INDICATORS

A New Concept In Weight Indication for the Well Servicing Unit



Where no deadline anchor is required, the MIDGET anchors the line with a heavy-duty, extremely rugged hydraulic cylinder and piston. The signal developed is transmitted to the gauge maintained near the hoist operator.

The gauge is a 6" fluid filled instrument of the highest quality with a damper for adjusting the pointer movement to the proper sensitivity. The fluid filled case also reduces severe pointer movement and lubricates and protects the working parts.

Two pointers are provided, one reads the total hook load in pounds for two or four lines strung, and the other is a target pointer.

A quick coupling located in the rear of the instrument box permits the cylinder and hose assembly units to be quickly separated without loss of fluid or altering the calibration.

MARTIN DECKER
WRITE FOR DESCRIPTIVE LITERATURE
MARTIN-DECKER CORPORATION, DEPT: P-98
3431 CHERRY AVENUE, LONG BEACH 7, CALIF.
World's principal manufacturer of Oil Well Drilling Instrumentation

Designed To Help Industry Meet A Real Problem

THE DRINKING PROBLEM
. . . and its control

By C. A. D'Alonzo, M.D., F.A.C.P.

Price $3.50

This book deals not only with alcoholism generally, but also with its effects, care and treatment when encountered on the job. It provides answers to many important questions such as: What is alcoholism? What is industry's role in the problem of alcoholism? What are the community problems related to alcoholism? What are the major signs that indicate existence of a drinking problem? What is the treatment? Is there a cure?

The author is assistant medical director of E. I. Du Pont de Nemours and Co., Inc. Du Pont is well known for its efforts to rehabilitate the alcoholic worker.

Order from your bookstore, or:
Book Department
Gulf Publishing Company
P. O. Box 2608, Houston 1, Texas

Men in the industry

J. A. Walstrom, president, **Shell Caribbean Petroleum Company,** has accepted the chairmanship of the first nationwide fund raising and public relations campaign of the National Hemophilia Foundation. The "Campaign" will reach its climax during National Hemophilia Month February 1 through February 28, 1962.

J. A. Walstrom

C. L. DeuPree

Charles Lamar DeuPree has been appointed executive secretary of the Association of Oilwell Servicing Contractors. The AOSC is a national association of contractors who service oil and gas wells throughout the U.S.

M. R. Smith has been named district engineer in **Gulf Oil Corporation's** Denver, Colo., production district office. He previously was production engineer in Monahans, Texas. Smith succeeds **W. E. Bauman,** who has been appointed area production manager in Amarillo, Texas.

W. H. Medary, Lafayette, La., Exploration superintendent for **Tenneco Oil Company,** has been named southeastern division exploration superintendent with headquarters in Lafayette.

I. R. Gardescue, vice president of **H. Zinder and Associates,** Houston oil and gas industry consulting firm, has been named director of the geological division. **Tom L. Kister** will succeed Gardescue as manager of the Houston office.

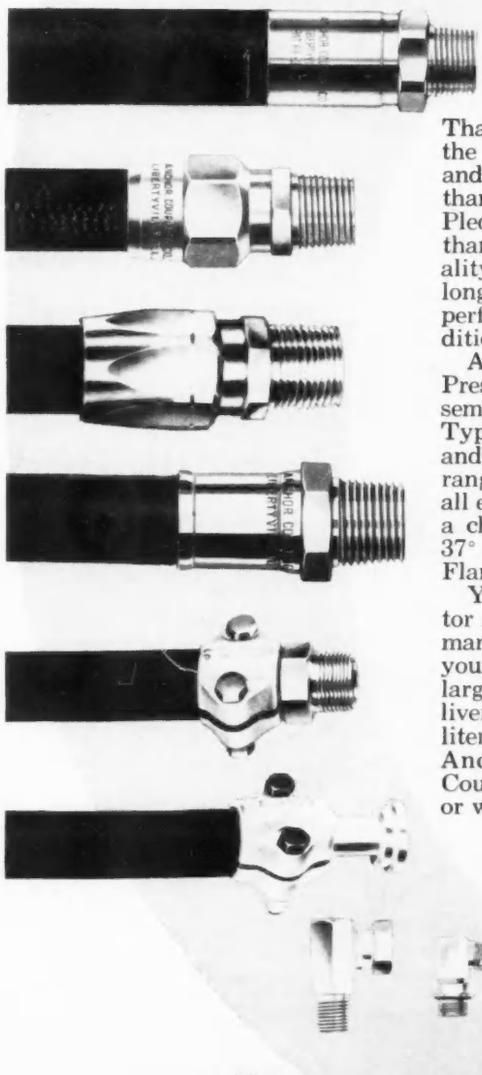
Thomas R. Smith, has been named area production engineer for **Humble Oil & Refining Company** in Mattoon, Ill. He previously was district engineer for Humble in Great Bend, Kan.

Richard S. Johnson has joined **Rocky Mountain Natural Gas Company** as area manager in Glenwood Springs, Colo. He previously was a petroleum engineer for **Honolulu Oil Corporation** in Cody, Wyo.

G. Harry Thompson and **Dr. W. F. James** have been named directors of **Home Oil Company, Limited.** Thompson is president of **Calgary Power, Limited,** and a director of **Montreal Engineering, Limited.** James is vice president and director of **Almine, Limited** which is associated with Home Oil in Alberta, Canada, exploration operations.

N. C. Elmer, consulting geologist, has joined **Trigood Oil Company** in Casper, Wyo.

Choose
YOUR REPLACEMENT
HOSE ASSEMBLIES and FITTINGS
. . . by proved performance



That proof is well established by the "first choice" of both O.E.M. and Replacement users over more than 20 years . . . "Anchor—The Pledge of Performance" is more than a slogan, it is a proved actuality in field-proved top quality, long operational life and peak performance under severest conditions.

Anchor's comprehensive line of Pressed-On Hydraulic Hose Assemblies, Reusable and Clamp-Type Reusable Couplings, Hose and Related Fittings offers a wide range of styles and sizes to meet all existing pressure demands and a choice of threads . . . NPTF, 37° and 45° Flare, or "O" Ring Flange Head.

Your nearest Anchor distributor . . . there's one in all principal markets . . . is qualified to advise you on your needs and carries a large stock for immediate delivery. Ask him for descriptive literature giving valuable data on Anchor Hydraulic Assemblies, Couplings, Hose and Fittings . . . or write direct.

ANCHOR Coupling Co. Inc.

BOX 111, DEPT. UU LIBERTYVILLE, ILL.
Branch Plants: Dallas, Tex., Plymouth, Mich.

CUT STUCK SAND LINES INSIDE TUBING

KINLEY SAND LINE CUTTER

J. C. KINLEY CO., Licensees

ABILENE, TEXAS
Eads Engineering Services, Inc.....OR 2-8655
ANDREWS, TEXAS
John Kuykendall Wireline Service Co....LA 3-4303
BAY CITY, TEXAS—J. P. Graham.....CI 5-4526
CASPER, WYOMING—C. A. White.....235-5264
FULLERTON, CALIFORNIA—Dyna-Log LA 6-1184
HOBBS, NEW MEXICO
Horne Well Service Co.....3-5396
KERMIT, TEXAS
John Kuykendall Wireline Service Co....JU 6-4538
KILGORE, TEXAS
Davis-Kemp Tool Co., Inc.....5541
LIBERAL, KANSAS—Rainbo Service...Main 4-3598
LINDSAY, OKLAHOMA
Rainbo Service Co.....PL 6-2530
MIDLAND, TEXAS
Lucecus Service & Eqpt. Co.....MU 2-8311
NATCHEZ, MISSISSIPPI
Davis-Kemp Tool Co., Inc.....442-3021
NEW IBERIA, LOUISIANA
Klein-Deen Wire Line Service.....EM 9-6632
ODESSA, TEXAS
John Kuykendall Wireline Service Co....FE 7-7210
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co.....ME 4-2131, ME 4-0105
RAWLINS, WYOMING—C. A. White....EM 2-6488
STERLING, COLORADO
Cable Drilling, Temp. & Well Serv. Co...LA 2-4761
VIDALIA, LOUISIANA
Davis-Kemp Tool Co., Inc.....ED 6-4224
WICHITA FALLS, TEXAS
Eads Engineering Services, Inc.....766-0931
EDMONTON, ALBERTA, CANADA
CAMCO, Ltd.....GE 9-3641 GE 9-3124

Men in the industry

Admiral Arleigh Burke, U.S. Navy (Ret.), has been elected a member of the board of directors and of the executive committee of **Texaco Inc.**

James S. Garvey, has been appointed an advisory director of the **Fort Worth National Bank.** Garvey is president of **Garvey Elevators, Inc., Service Oil Company** and **Farmers Grain Company.**

Donald W. Jackson, former manager for **Drilling and Production for Panhandle Eastern Pipeline Co.** has opened petroleum consulting offices in Liberal, Kan.

Lawrence Heyl, Jr., has been appointed public relations associate for the northern and southeastern Europe region of **Mobil International Oil Company.** Headquarters of this region is scheduled to move from New York to London next year.

James Overton, Jr., has been named area gas engineer for **Shell Oil Company's** New Orleans area to succeed **Richard Porter** who has been assigned to Shell's Midland, Texas, exploration and production area.

Garth L. Young, who continues as vice president in charge of foreign operations for **Signal Oil and Gas Company,** has been elected president of **Iricon Agency Ltd.** He succeeds **E. M. Benson, Jr.,** manager of land and lease division for **Richfield Oil Corporation.**

Dr. William B. Townsend has been named medical director for the **Humble Oil & Refining Co.'s** Southeast Region.

D. G. Roper, now at Casper, Wyo., has been promoted to landman special on the staff of the general manager, Domestic Producing Department of **Texaco Inc.**

Dr. Thomas F. Jacoby has been appointed an assistant technical director for **Alco Oil & Chemical Corporation.** Dr. Jacoby will replace **C. E. Cain** who has been named sales manager.

Arch W. Baucum and **Marion J. Epley Jr.,** have been elected to the newly created positions of executive vice president for **Texaco Inc. John W. Green,** vice president, domestic sales, senior vice president is in charge of worldwide marketing, succeeding Epley. **Homer O. Woodruff,** general manager, domestic producing succeeds Baucum as vice president of the department, and **John I. Mingay,** general manager, domestic sales department, succeeds Green as vice president and general manager of the department.

T. Frank Smith, Jr., and **R. B. Abney** have been elected manager and marketing manager of the Memphis Area respectively for the **Humble Oil & Refining Co.**

Melvin Kaitz, staff reservoir engineer in the Houston Exploration and Producing Division, has joined **Mobil Oil Company's** newly formed headquarter's Natural Gas Department as Natural Gas engineering supervisor. **Gilbert R. Watz** has been named to a position in crude oil price analysis in Mobil's Supply and Distribution Department.

J. H. Galloway, has become a general manager of the Central Region of **Humble Oil & Refining Co.,** with main offices in Tulsa. Galloway has been serving in Houston as general manager of the Southwest Region. **R. P. Ryan** succeeds Galloway. **A. L. Deaton,** succeeds Ryan as general counsel for the Central Region.

E. L. Stauffacher, vice president of **Cities Service Co., Inc.,** has been made chairman of the Petroleum Division of the New York Arthritis and Rheumatism Foundation.

M. B. Morris, general manager of the Exploration Department, has been appointed a vice president of **Hudson's Bay Oil and Gas Company Ltd.**

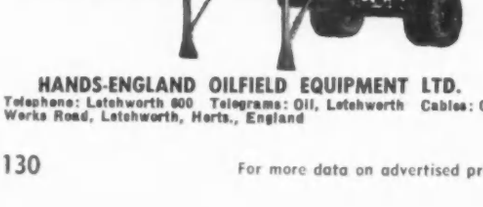
Donivan A. Hall has been appointed office manager for the Tulsa headquarters of Helmerich & Payne, Inc.

oilfield transporting equipment

OILFIELD TRUCK AND FLOAT
Thornycroft Sandmaster 252" wheel base Oilfield Truck. Hands-England full Oilfield Body. 60,000 lb. winch, heavy duty gin poles, winch operated gin pole risers and folding SAE king pin.
Hands-England 75,000 lb. capacity, tandem axle Oilfield Float 30'0" long and 9'6" wide, folding support legs and inverted 36" fifth wheel.
Truck and Float on Michelin 18.00 x 25. Sahara "X" sand tires.

OILFIELD FLOAT
Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30'0" long and 8'6" wide, folding support legs and inverted 36" fifth wheel.
Float on 11.00 x 20—14-ply tires.

OILFIELD TRUCK AND FLOAT
Scammel Constructor 261" wheel base Oilfield Truck.
Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30'0" long and 9'6" wide folding support legs and inverted 36" fifth wheel.
Truck and Float on 14.00 x 20—18-ply tires.



OILFIELD FLOAT
Hands-England 25,000 lb. capacity single axle Oilfield Float 24'0" long and 8'0" wide, folding support legs and SAE king pin 11.00 x 20—12-ply tires. Steel stake sides.

SUPPLIED BY

HANDS-ENGLAND OILFIELD EQUIPMENT LTD.
Telephone: Letchworth 600 Telegrams: Oil, Letchworth Cables: Oil, Letchworth, England
Works Road, Letchworth, Herts., England

PSI
WORKOVER
UNDER PRESSURE

PSI PIPE SNUBBING SERVICES insures an economical and safe means of running and pulling pipe under pressure in workover and drilling operations. Ten years experience on many wells provides the operator the utmost in safety and efficiency.

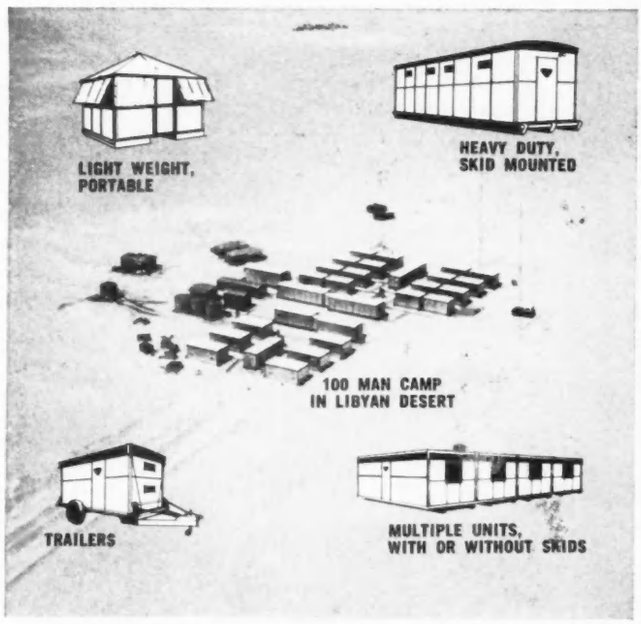
In workover operations the PSI snubbing method eliminates mud costs (the well need **NOT** be killed) and prevents water or mud contamination of producing zones.

When unusual well problems are presented by high pressures, PSI personnel and equipment are available at any hour and are as near as your telephone or radio.

PRESSURE SERVICES, INC. HAS THE PERSONNEL–EQUIPMENT–EXPERIENCE TO INSURE SAFE–RELIABLE–ECONOMICAL SNUBBING SERVICES

Pressure Services, Inc.

2683 Freewood • Dallas, Texas
Telephones:
FLeetwood 2-7992, FLeetwood 1-6006, CHapel 7-4819


LIGHT WEIGHT, PORTABLE
HEAVY DUTY, SKID MOUNTED
100 MAN CAMP IN LIBYAN DESERT
TRAILERS
MULTIPLE UNITS, WITH OR WITHOUT SKIDS

LOW COST, RUGGED FIELD HOUSING

Fast delivery • Save up to 80% on freight • Skid or wheel mounted • World's leading camp outfitters • Write:

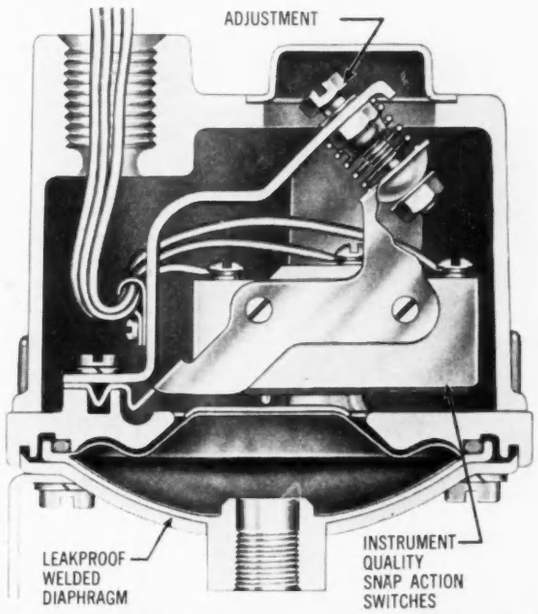
PORTA-KAMP MANUFACTURING CO., INC.

3601 West 12th Houston, Texas
Cable: PortaKamp, Houston

PORTA-KAMP HOUSTON

BREAKTHROUGH IN PRESSURE SWITCH ACCURACY
at reduced prices

The high accuracy of ±½ percent associated with instruments costing several hundred dollars is now obtainable with new Barksdale pressure switches at a retail cost of $19.00 to $30.00. Substantial price reduction is accomplished by use of erector set design and a major investment in production tooling. A wide choice of "tailored to the job" features meets your specification requirements exactly.



THESE POINTS ARE IMPORTANT

WE BUILD IN	WE DON'T USE
EXTREME ACCURACY and DEPENDABILITY maintained during operating life due to direct acting design	LINKAGES & BEARINGS which, as they wear, make the setting of the pressure switch drift.
OPERATION IN ANY POSITION which saves the installation costs encountered in mounting a switch that uses liquid switching elements	LIQUID SWITCHING ELEMENTS which make the switch difficult to mount and very critical to vibration.
IMMUNITY TO VIBRATION you can mount the switch directly on your vibrating or moving equipment.	ACCORDION BELLOWS which make the pressure switch sensitive to vibration.

Barksdale PRESSURE SWITCH DIVISION

Barksdale valves

Ask for new catalog and handbook

5125 Alcoa Avenue, Los Angeles 58, California

COMPLETE
INTEGRATED
SERVICE

CONTINENTAL'S GOT IT...
Worldwide!

First Aid depends on close teamwork . . people working together when trouble strikes. Teamwork is equally necessary for good oilfield service . . and it can come only from a completely integrated company. Continental's integrated team gives you complete service! Thousands of Continental people work together . . in the fields, in the plants . . on research and development, maintenance and management teams . . to save you time, trouble and money . . worldwide!

CONTINENTAL EMSCO

CONTINENTAL-EMSCO COMPANY, a Division of The Youngstown Sheet and Tube Company
General Offices: Dallas, Texas
Export Office: New York, New York

G61-31

Men in the industry

New Orleans Geologists Elect Officers

The newly elected officers of the New Orleans Geological Society for the 1961-62 year are (left to right): L. David Collier, Hudson Gas and Oil Corp., secretary; Leonard L. Limes, consulting geologist, president; Harold N. Hickey, The California Co., director for a two-year term; Lyle H. Harvey, John W. Mecom, director for a three-year term; Robert J. Ingram, The California Co., treasurer, and James M. Bibee, Gulf Corp., vice president.

J. Norman Baxendale, formerly regional drilling superintendent of the Mid-Continent and Rocky Mountain region, has become the assistant manager of foreign operations for **Kerr-McGree Oil Industries, Inc. John Cox,** formerly in charge of engineering and maintenance in Morgan City, La., has taken on the duties of chief engineer and manager of domestic land drilling operations. **Marvin Bender,** regional drilling engineer, has taken over Cox's engineering duties in the Gulf coast. **C. D. Blanchard,** formerly a toolpusher, has become assistant Gulf coast drilling superintendent.

Wirt Franklin, Ardmore, Okla., has been awarded the Oklahoma Petroleum Council's first Outstanding Oklahoma Oil Man Award.

Robert A. Greenkorn and **Calvin C. Mattax** have been named research associates in the production division of **Jersey Production Research Company.**

Ben H. Caudle and **Allen M. Rowe, Jr.,** have been named to the Texas Petroleum Research Committee staff at The University of Texas. TPRC is a state research unit established in 1947 to develop new ways of recovering Texas oil. The committee is operated cooperatively by The University of Texas, Texas A & M College and the Texas Railroad Commission.

Meyer Luskin has been appointed president and chairman of the board of **Southern California Petroleum Corporation.**

Charles Pendexter and **Gerald M. Webster** have been named research associates at **Jersey Production Research Company.**

Hallan N. Marsh, a California petroleum consultant, has been announced as the recipient of the John Franklin Carll Award from the Society of Petroleum Engineers.

William R. Boyd, III, has been appointed director of aviation and government sales for **Cities Service Company. Earl M. Pittman, Jr.,** Cities Service Government Sales Department, will serve as assistant to Boyd.

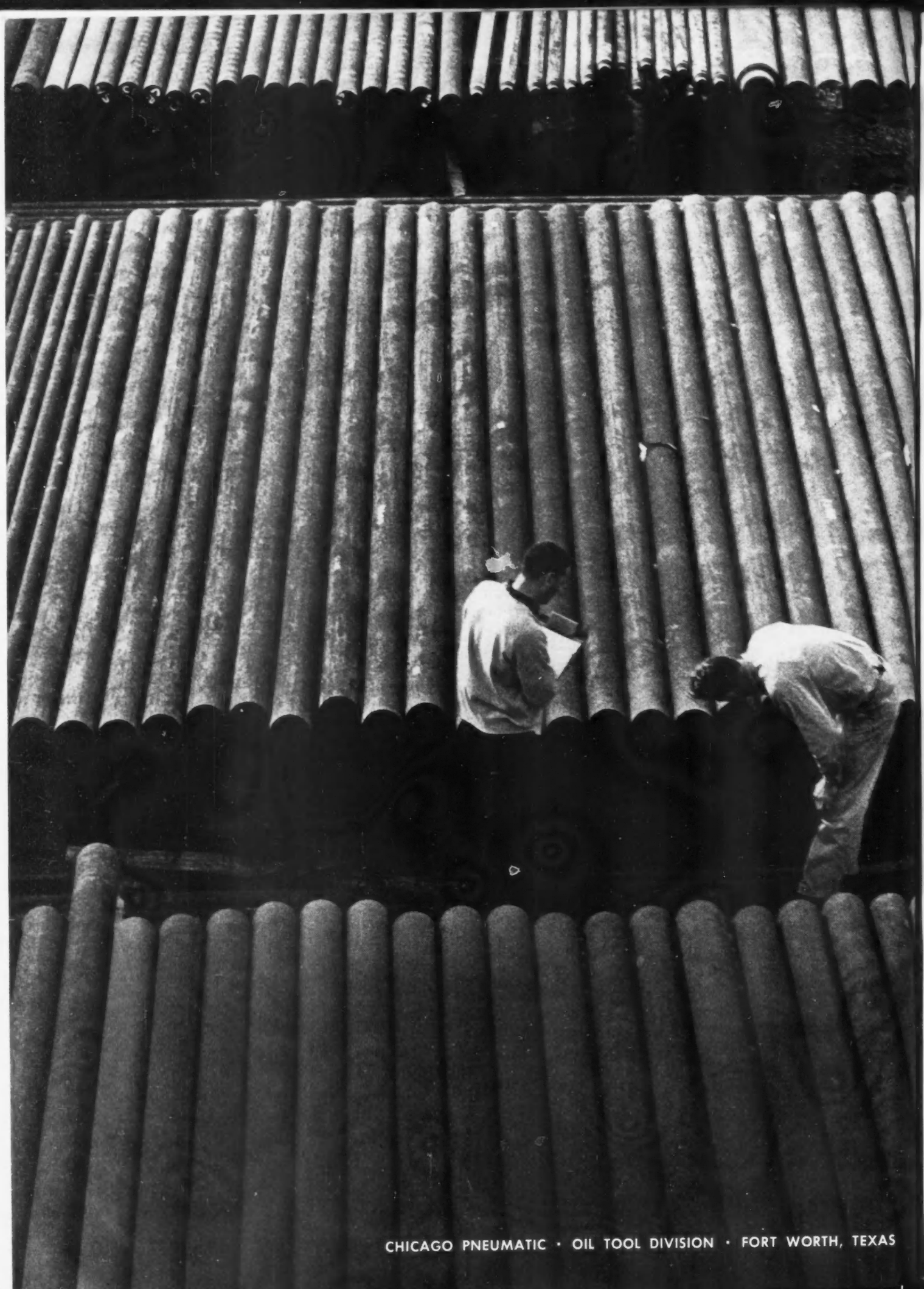
Carl E. Youngren of Calgary, district geologist for **L-M Oil Company, Ltd.** (a **Monsanto Chemical Company** subsidiary operated by **Lion Oil Company**); and **Leslie W. Andrews** of Denver, senior geologist for Lion's Denver district, have been appointed resident geologists in Lion's Key Geologist and Geophysical Advancement Plan.

Clayton Nygaard, a veteran of 25 years' experience in the oil business, has been appointed a district production superintendent in Calgary for **Ambassador Oil Corporation.**

Sam B. Olden, inter-governmental affairs advisor for **Socony Mobil Oil Company,** has been appointed general manager of Mobil Producing Tunisia.

J. F. Tolleson, Paris representative, has been appointed area manager, Europe and the French Community, with **D. B. Eicher,** formerly staff geologist at Houston, becoming area exploration manager for **Continental Oil Company. J. R. Strong,** New York, senior staff geophysicist, has been appointed area exploration manager, Africa. **J. F. Mason,** New York, staff geologist, has been appointed area exploration manager, Eastern Hemisphere. **W. A. Peterson,** New York, staff geologist, has been appointed area exploration manager, Western Hemisphere.

Donald G. Espey has succeeded **W. J. Reitze** as manager of sales engineering for the Esso Standard Region, **Humble Oil & Refining Co.** Reitze recently was named regional manager of consumer sales. Espey has been assigned to sales engineering at Esso headquarters in New York City since 1947.



CHICAGO PNEUMATIC · OIL TOOL DIVISION · FORT WORTH, TEXAS

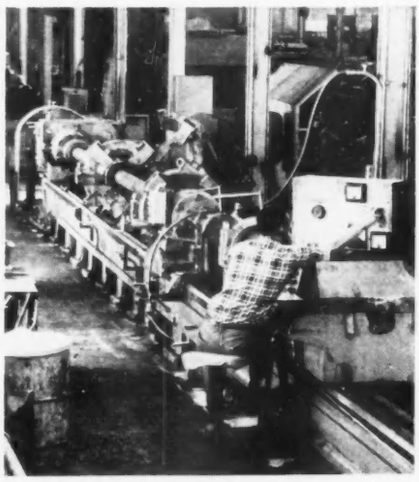
DRILL COLLARS IN THE "RAW"

These CP Drill Collar blanks started with an exact metallurgical analysis . . . were then heat treated to develop the ideal characteristics of strength and wear resistance precisely right for your needs.

You can't buy a better Drill Collar than CP. Precision bored on our own trepanning machines they are "perfect in every detail" . . . thread form . . . wall thickness . . . balance . . . metallurgy.

Insist on CP Drill Collars, they'll provide the weight and give your string the true-running qualities that make holes faster. And they'll be delivered right on schedule.

At CP we know that you've "no time for downtime."



WE HAVE EXPERT DRILLERS, TOO . . . their job is making hole in chrome steel. They drill horizontally and the rig is a trepanning machine of our own design!

Chicago Pneumatic
FORT WORTH, TEXAS

BITS • DRILL COLLARS
REAMERS • TOOL JOINTS

Associations

L. F. McCollum

F. N. Ikard

E. D. Brockett

J. H. Abernathy

L. F. McCollum Named API Chairman, Porter Renamed, Ikard in New Post

L. F. McCollum, president of Continental Oil Co., will succeed Standard Oil Co. (New Jersey) President M. J. Rathbone as Chairman of the Board of the American Petroleum Institute. McCollum, an ex-oil scout and geologist, was graduated from the University of Texas in 1925 with a degree in geology. He has been president of Continental Oil since 1947.

E. D. Brockett, president of Gulf Oil Corp., was elected vice president for transportation. He succeeds Henderson Supplee, Jr., president of Atlantic Refining Co.

Frank M. Porter, New York, was reelected API president. Frank N. Ikard, who recently resigned his post as Texas Congressman, was reelected executive vice president.

Others reelected were Gage Lund, Standard Oil Co. of California, vice president for production; Vernon A. Bellman, Mobil Oil Co., vice president for marketing; A. P. Frame, Cities Service Co., vice president for refining; and A. O. Savage, Standard Oil Co. (New Jersey), vice president for finance and accounting.

P. C. Spencer, Sinclair Oil Corp., was reelected API treasurer, and Willard M. Wilson of the Institute staff was reelected secretary.

Also, 26 certificates of appreciation were presented during the annual meeting in Chicago, including the following in the Division of Production: Jack H. Abernathy, Big Chief Drilling Co., Oklahoma City; R. E. Foss, Sunray Mid-Continent Oil Co., Tulsa; W. M. Frame, National Tube Division, U. S. Steel Corp., Pittsburgh; James R. Hatfield, Cities Service Petroleum Co., Bartlesville, Oklahoma; Earle C. Hellums, Gracey-Hellums Corp., Houston; W. P. Kliment, Crane Co., Chicago; Joseph Zaba, Pan American Petroleum Corp., Tulsa.

J. R. Hatfield

E. C. Hellums

J. C. Donnell II, president of The Ohio Oil Co., was presented the American Petroleum Institute's Carl A. Young Memorial Award for meritorius service to the oil industry.

Sixth World Congress Plans Are Developing

Plans are developing for the Sixth World Petroleum Congress, to be held from June 19 to 26, 1963 at Frankfort, West Germany. The German organizing

To Serve as Illinois Geological Officers

These Illinois Geological Society Officers will serve for the 1961-62 term (left to right): Eugene Frund, secretary-treasurer, Humble Oil & Refining; Dale Finley, vice president, Pure Oil Co.; Kenneth Boling, president, Indiana consultant; Charles Baurer, retiring president, Humble Oil; and James Shackelford, recorder, Kingwood Oil Co.

For more data on advertised products, use cards, last page.

committee and the executive committee of the permanent council of World Petroleum Congresses have determined some new procedural rules for the Sixth World Petroleum Congress aimed at concentrating the scientific work.

Inquiries should be directed to the General Secretariat for the Sixth World Petroleum Congress, Hamburg 1, GlockengieBer Wall 2-4, "Wallhof," West Germany.

The scientific program is divided into eight sections: geophysics and geology; drilling and production; processing and refining; base stocks from petroleum and natural gas for the chemical industry; composition, analysis and testing; utilization of natural gas and petroleum products; engineering, including materials and transportation; and operations research, statistics and training. A total of 240 reports on scientific subjects will be presented, half of which will be discussed with the aid of simultaneous translation.

Official languages of the Sixth World Petroleum Congress are English and French. German is also admitted. All scientific publications will be written either in French or English; abstracts of the papers will be written in all three languages. The eight sections will meet simultaneously in eight separate conference rooms.

Geological excursions, and visits to oil industry plants will be organized for days or periods before and after the meeting. These one- to seven-day trips will take place in West Germany, France, Austria and the Benelux countries.

The United States National Committee for the Sixth World Petroleum Congress has been organized with offices in New York City at Room 1719, 15 West 51 St., and at the American Petroleum Institute, 1271 Avenue of the Americas.

MORE SPEED...MORE SPACE
WORLD-WIDE SERVICE

Profitable words to remember when you're looking for speed and dependability: Air France Cargo Service. Air France cargo flights carry oil-drilling equipment to key points across the world . . . Near East, West Africa, Central Africa, Algeria, the Sahara, and more! Frequent departures throughout the week from New York, Los Angeles, Chicago, Montreal. Every flight carries 10,000 lbs.! You save on crating, shipping weight. New low insurance costs, too! Air France speeds cargo to more cities in more countries than any other airline. Specify Air France to your Cargo Agent!

AIR FRANCE CARGO

1962
OIL DIRECTORIES

17 pocket-size, plastic-bound personnel directories covering the buying power of the entire oil industry of the world, from top executives to foremen. Over 135,000 key men are listed. First seven books cover Producing and Drilling Contracting.

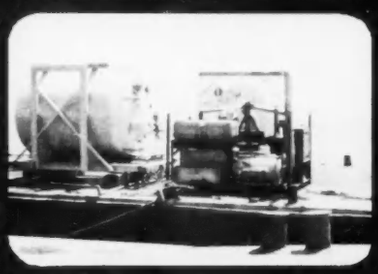
We Send Our Directories on Approval

1. Texas
2. Oklahoma
3. California
4. Kansas
5. Mich. - Ill. - Ind. - Ky. and Eastern States
6. La. - Ark. - Miss. - Ga. - Fla.
7. Rocky Mountain Region and New Mexico
8. Oil Well Drilling Contractors (Covers the World)
9. Refining, Petrochemical, Construction and Natural Gas Processing Plants of the World
10. Pipe Line Companies and Pipe Line Contractors (Covers the World)
11. Oil Directory of Companies Outside the U. S. A. and Canada
12. Oil Directory of Canada
13. Directory of Geophysical and Oil Companies Who Use Geophysical Service
14. Directory of Oil Well Supply Companies (Covers the World)
15. Oil Directory of Houston, Texas
16. Oil Directory of Alaska
17. Directory of Gas Utility Companies (Covers the U. S. A.)

MIDWEST OIL REGISTER, INC.
DRAWER 7248, TULSA, OKLAHOMA
C. L. Cooper, Publisher

NOWSCO Nitrogen saves twice on offshore job #1926

IN 3 HOURS! NOWSCO BRINGS IN 2 MILES OF WELL... PURGES 2 MILES OF UNDERSEA LINE...



This NOWSCO skid unit's starting a 12 hour ride out to a well in the Gulf of Mexico off Galveston, Texas. No time wasted on arrival, with hookup to tree 15 minutes after securing barge. Here's the sequence on this job . . . first, well fluid is displaced down 2" tubing 8000 feet into formation. Next, an overflush with 20,000 scf of Nitrogen dissolves into formation fluid during a 2 hour shut-in period. This provides bubbles to push fluid up and out, when pressure is released later.

While well is shut in, Nitrogen is injected into the 4" undersea line, unloading approximately 125 BBLS oil into shore batteries 2 miles away. Line purged of dead oil in 1½ hours.

Now, well is brought in by controlled bleeding of the Nitrogen to atmosphere, then reconnected to the undersea line for continued production. Time for both operations—about 3 hours!

You save time and trouble when you call in NOWSCO . . . first in liquid Nitrogen well techniques, with a background of more than 2000 cost-saving Nitrogen service jobs. NOWSCO transport-pump trucks are operated by veteran oil field workers, who are well qualified to handle unusual situations, to calculate individual injection rates, pressures, volumes.

NOWSCO service trucks and operators are stationed on 24-hour ready at Houston, Corpus Christi, Victoria, Odessa, Orange, Longview, Texas and Lafayette, La. Other stations will be opened soon in Monroe and New Orleans in La., and in Jackson, Miss.

Want the NOWSCO story on your field conditions? Write or call today.

Originator and prime authority on liquid nitrogen techniques...

NOWSCO

NITROGEN OIL WELL SERVICE COMPANY

3602 West 11th Street, Houston, Texas. Tel: UN 4-0965 or UN 4-7701

4

EASY WRENCHING
FAST MAKE-UP

3

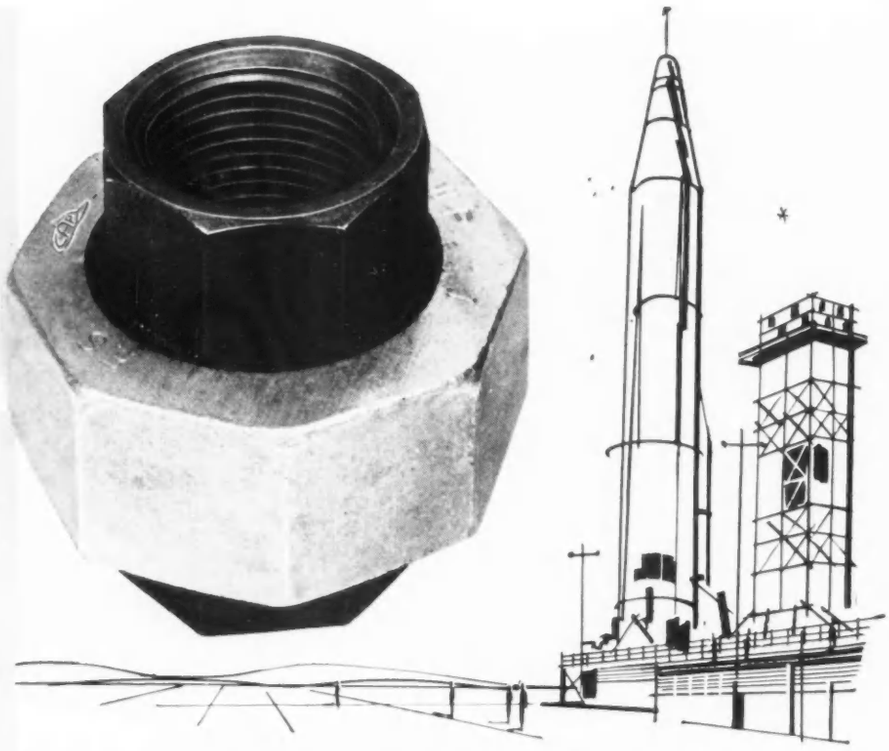
CLEAN/OVER-ALL PROTECTION

2

POSITIVE SEATING

1

LEAK-PROOF CONNECTIONS



Capitol count down

– INSURES NO FAILURES!

A union is more than a fitting. Installed, it is a refinery . . . a skyscraper . . . an atomic-energy plant! Continued operation depends on it.

And you can count on Capitol forged steel unions . . . because they give you 4-way service insurance.

(1) *Leak-proof connections* assured because Capitol unions have *more* threads, accurately cut and double-checked according to Army-Navy gauging practice. Both hand-tight and pressure-tight threads are checked, two operations instead of the one required for American Standard gauging. The extra threads mean on-the-job assurance of tight installations. (2) *Positive seating* because each union is individually pressure-tested. (3) *Clean/over-all protection*, each male and female part completely phosphate coated; each nut electro-zinc plated. (4) *Easy wrenching/faster make-up* because all three parts have a definite octagon shape.

You get all 4 important advantages at no extra cost when you specify CAPITOL forged steel unions . . . one of the full-line of Army-Navy gauged forged steel fittings. Now more than one million in service . . . and not a single failure.

CAPITOL MANUFACTURING CO.,
Division of Harsco Corporation, Columbus, Ohio.

SPECIFY CAP FOR ALL FITTINGS

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

CAPITOL

Associations

Harold Decker Named 1962 IPAA President

Harold Decker, Houston, was elected president for 1962 of the Independent Petroleum Association of America at the annual meeting in Houston as members accepted the full slate of nominees submitted by the nominating committee.

Harold Decker

The president of the Highland Oil Co. will succeed Col. Alvin C. Hope of San Antonio on Jan. 1 as head of the 7,000-member organization.

William S. Kilroy, president of the Kilroy Company of Texas, Inc., Houston, has been elected vice president for the Southeast Texas region. He will succeed Noble C. Ginther, Sr., also of Houston.

W. L. Kistler, Jr., Tulsa, has been named treasurer. Staff officers reelected were Minor S. Jameson, Jr., Washington, executive vice president; L. Dan Jones, Washington, general counsel, and I. C. Huff, Jr., Tulsa, executive manager and secretary.

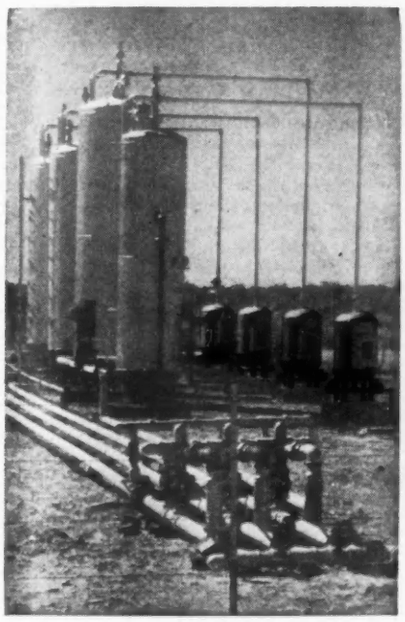
New executive committeemen elected were: W. T. Blackburn, Denver, C. J. Davidson, Fort Worth, F. Clinton Edwards, Midland, Jake L. Hamon, Dallas, Elmo Holder, Evansville, Ind., J. Stuart Hunt, Dallas, J. C. Hunter, Jr., Abilene, George C. Martin Oklahoma City, T. M. Martin, El Dorado, Ark., Patrick J. McDonough, Billings, Mont., E. Bruce Street, Graham, H. A. True, Jr., Casper, Wyo., W. M. Vaughey, Jackson, Miss., and Watson W. Wise, Tyler.

New area vice presidents will include: Glenn C. Ferguson, Bakersfield, Calif., Floyd Collins, Mount Vernon, Ill., Robert F. Eberle, Evansville, Ind., Fred I. Murfin, Wichita, Kan., Alfred E. Beasley, Monroe, La., Frank M. Ritchie, New Orleans, Paul Strain, Wrenshall, Minn., Robert L. Reed, New York City, Herbert G. Officer, Bismarck, N.D., W. E. Shrider, Neward, Ohio, S. M. Anderson, Jr., Oklahoma City, George A. Wilson, Dallas, C. C. Coulston, Tyler, J. W. Starr, Midland, R. S. McKnight, Salt Lake City, H. B. Gernert, Casper, Wyo., and Kilroy.

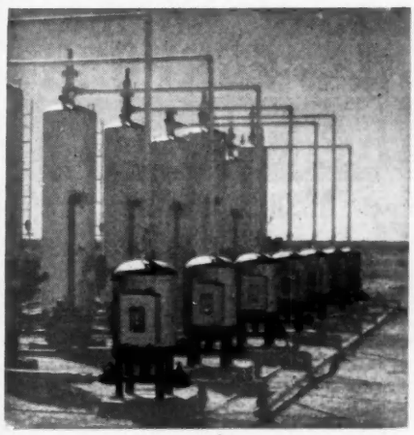
Libyan Group Plans Yugoslavian Trip

The Petroleum Exploration Society of Libya, Tripoli, will hold its fourth annual field trip conference in May 1962 in Yugoslavia. Tentative plans call for a geologic trip in the Dalmatia coastal areas with possible overnight stops at Dubrovnik, Sarajevo, Jajce and Tucepi. The trip will be limited to 80 members. The editor of the Field Trip Guide Book is Dr. Louis C. Conant, U.S.G.S./U.S.O.M. Robert T. Brady, Amoseas, is the chairman of the field trip committee.

METROL®
"CV" VOL-U-METERS®



METROL MODEL 10-CV-01 Vol-U-Meters metering and commingling oil from four separate royalty interests into a common tank battery.



METROL 10-CV-01 Vol-U-Meters metering and commingling oil from seven dual completed wells into a common tank battery.

METROL® "CV" VOL-U-METERS® are designed for accurate metering of crude oil and water by cyclic accumulation, isolation and discharge of equal volumes.

METROL "CV" VOL-U-METERS are available in standard sizes, ¼, ½, 1, 2, 5, 10, 20 and 30 barrels per dump. Standard working pressures are 125, 300, 600 and 1200 psi. Capacities are shown in table below.

Metering accuracy of METROL "CV" VOL-U-METERS depends on proper liquid level control and proper valving, both of which are obtained and maintained. Accuracies of 99.99% are common. This accuracy is attributed to the vessel's patented snap-acting pilot mechanism*. Pilots used on VOL-U-METERS are reliably accurate and react at exact preset upper and lower levels. VOL-U-METERS are approved by most regulatory bodies for measuring oil for royalty and tax payments, testing wells, and commingling oil.

Average repair parts cost for METROL "CV" VOL-U-METERS is less than $5.00 per unit per year! Ruggedness and simplicity of these units, added to their high accuracy and dependability, make them the best meter for metering crude oil upstream of lease storage tanks.

Accurate metered volumes, low maintenance cost, trouble-free operation, efficient and accurate handling of production, increased field safety, and additional lease automation are among advantages provided by METROL "CV" VOL-U-METERS.

UNIT MODEL NO.	2½ CV	5 CV	10 CV	20 CV	50 CV	100 CV	200 CV	300 CV
Volume per dump, Bbl...	¼	½	1.0	2.0	5.0	10.0	20.0	30.0
Metering Capacity BPD								
Rated.....	300	500	720	1,440	2,000	4,000	8,000	15,000
Maximum.....	500	650	1,200	1,800	3,000	5,000	12,000	20,000
Avg. Expected Metering Accuracy, Percent.....	99.80	99.90	99.95	99.97	99.98	99.99	99.99	99.99

U. S. Patent No. 2,818,738

® Trade Mark Registered U. S. Patent Office

We solicit your inquiries.

Every Unit is completely assembled, pressure tested, calibrated, and performance tested prior to shipment.

Competent Sales and Service Representatives located in all major oil areas.

OIL METERING and Processing EQUIPMENT CORP.
MELROSE 5-1226 • 4843 YALE STREET
HOUSTON 18, TEXAS

P.O. Box 10777, Houston 18, Texas

New

Non-Flammable
ALL-PURPOSE
Rig Cleaner

DERRICK FLOOR

Keeps floor clean, safe, slip-free.

ENGINES

Non-Flammable, works on hot engines, will not hurt paint.

PAINTED SURFACES

Actually brightens paint surface, with no streaking after-effects.

Can be applied by
Rag . . . Brush . . . Jet
(DILUTES IN FRESH OR SALT WATER)
Economical, too!

SOLD THRU SUPPLY STORES

PC-5 Rig Cleaner is sold thru supply stores exclusively. For a limited time, you can obtain a sample from your favorite supply store. If your store manager does not have his supply of samples yet, get him to call or write:

Red Adair Chemical

P. O. Box 10744 Phone OV 6-5573
Plant Address: 2102 Pasket
Houston, Texas 6102

Who's Meeting Where

DECEMBER

Utah Petroleum Council annual meeting, Prudential Building, Salt Lake City, Utah, Dec. 1.

AIME SPE, Arizona section annual meeting, Pioneer Hotel, Tucson, Dec. 4.

IOCC, annual meeting, Denver-Hilton Hotel, Denver, Dec. 4-6.

1962

JANUARY

Minnesota Section AIME, annual meeting, University of Minnesota, Duluth, Jan. 15-17.

Mississippi Petroleum Committee meeting, Heidelberg Hotel, Jackson, Miss., Jan. 17.

NACE Canadian Region Eastern Division conference, King Edward Hotel, Toronto, Ont., Jan. 17-19.

Kansas Oil Men's Association, annual meeting, Broadview Hotel, Wichita, Kansas, Jan. 21-23.

FEBRUARY

Petroleum Equipment Suppliers Association, Eastern District meeting, Pittsburgh, Pa., Feb. 13.

Southwestern Legal Foundation, 13th annual institute on the law of oil, gas and taxation, Southwestern Legal Center, Dallas, Feb. 14-16.

Petroleum Equipment Suppliers Association, Pacific District meeting, Los Angeles, Feb. 15.

AIME, annual meeting, New York City, Feb. 18-22.

AAPG, Rocky Mountain section, 12th annual meeting, Salt Lake City, Utah, Feb. 26-28.

International Oil & Gas Educational Center, institute on economics of the gas industry, Southwestern Legal Center, Dallas, Feb. 28-Mar. 2.

API, Division of Production, Southern District meeting, Rice Hotel, Houston, Feb. 28-Mar. 2.

MARCH

Petroleum Equipment Suppliers Association, Gulf Coast District meeting, Houston, Mar. 1.

Ohio Oil & Gas Association winter meeting, Deshler-Hilton Hotel, Columbus, Ohio, Mar. 2.

Petroleum Equipment Suppliers Association, Northern-Mid-Continent district meeting, Tulsa, Mar. 6.

AGA Natural Gas Reserves Committee meeting, Hotel Galvez, Galveston, Texas, Mar. 8-9.

SPE of AIME, economics and valuation symposium, Dallas, Texas, Mar. 15-16.

NACE Board of Directors meeting, Hotel Muehlebach, Kansas City, Mo., Mar. 18.

NACE, 18th annual conference and 1962 corrosion show, Municipal Auditorium, Kansas City, Mo., Mar. 19-23.

API, Division of Production, Southwestern District meeting, Lincoln Hotel, Odessa, Texas, Mar. 21-23.

New England Gas Association, annual meeting, Statler-Hilton Hotel, Boston, Mar. 21-23.

NACE, Board of Directors meeting, Hotel Muehlebach, Kansas City, Mo., Mar. 23.

SPE of AIME, Rocky Mountain Petroleum sections, 8th annual joint meeting, Billings, Mont., Mar. 24-25.

AAPG, annual meeting jointly with AAPG-SEPM-SEG Pacific sections, Fairmont Hotel, San Francisco, Mar. 26-29.

APRIL

API, Division of Production, Mid-Continent District meeting, Sheraton-Oklahoma Hotel, Oklahoma City, Apr. 4-6.

SPE of AIME, Upper Gulf Coast region, drilling and production practices conference, Beaumont, Texas, Apr. 5-6.

Mid-West Gas Association, annual meeting, Hotel Radisson, Minneapolis, Apr. 9-11.

API, Division of Production, Rocky Mountain District, Denver Hilton Hotel, Denver, Apr. 11-13.

SPE of AIME, production research symposium, Tulsa, Okla., Apr. 12-13.

ASME, Oil & Gas Power Division Conference, Shoreham Hotel, Washington, D. C., Apr. 15-18.

International Oil & Gas Educational Center, institute on public affairs and public relations in the oil industry, Southwestern Legal Center, Dallas, Apr. 19-20.

AAPG, Rocky Mountain section, 12th annual meeting, Salt Lake City, Utah, Apr. 23-25.

IPAA, mid-year meeting, Hotel Muehlebach, Kansas City, Mo., Apr. 29-May 1.

Empire State Petroleum Association, spring convention, Statler-Hilton Hotel, Buffalo, N.Y., Apr. 29-May 1.

AGA, Operating Section, transmission conference, combined with Southern Gas Association annual convention, Houston, Apr. 30-May 2.

MAY

API Division of Finance & Accounting, midyear meeting, Americana Hotel, Bal Harbor, Fla., May 2-4.

SPE of AIME, 5th biennial secondary recovery symposium, Wichita Falls, Texas, May 7-8.

API, Accident Prevention and Fire Protection Committees meeting, Denver Hilton Hotel, Denver, May 7-11.

API Division of Production, Pacific Coast District meeting, The Biltmore Hotel, Los Angeles, Calif., May 10-11.

API Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus Ohio, May 16-18.

SPE of AIME, production automation meeting, Hobbs, N.M., May 17-18.

AIME, Rocky Mountain petroleum sections, 8th annual joint meeting, Billings, Mont., May 24-25.

JUNE

AGA, Operating Section, production conference, Statler Hotel, Boston, June 4-5.

API, Division of Production, mid-year committee conference, Jung Hotel, New Orleans, June 10-15.

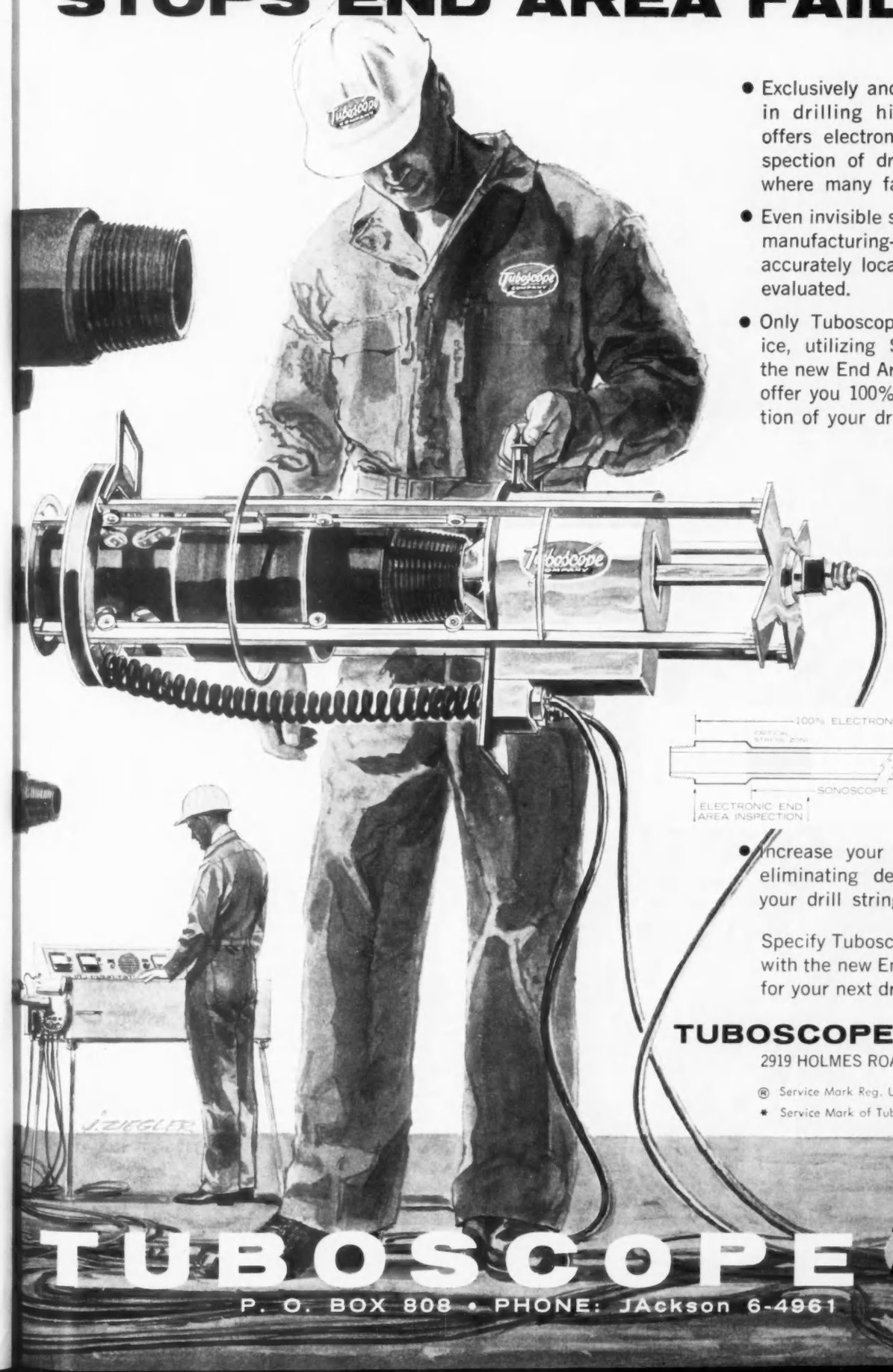
Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec, Canada, June 20-23.

Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich., June 25-26.

Nomad's Chapter monthly meeting: **Los Angeles,** second Wednesday, Biltmore Hotel, Wallace A. Sawdon, Secretary. **Houston,** second Monday, Kaphan's, Elbert T. Walker, Secretary. **Dallas-Ft. Worth,** first Monday, Greater Dallas Club, Hank Davis, Secretary. **Tulsa,** Hotel Tulsa, Gilbert Swift, Secretary. **New York,** first Monday, Hotel Biltmore, Jesse E. Hickman, Secretary.

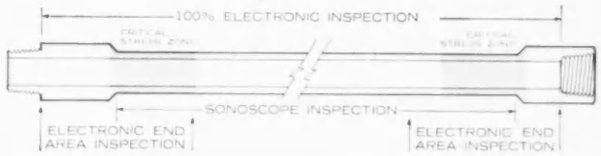
Now! Drill Pipe end areas electronically inspected with new End Area Instrument!

NEW INVENTION STOPS END AREA FAILURE!



- Exclusively and for the first time in drilling history, Tuboscope offers electronically accurate inspection of drill pipe end areas where many failures occur.
- Even invisible service-induced and manufacturing-origin defects are accurately located, identified and evaluated.
- Only Tuboscope inspection service, utilizing SONOSCOPE® and the new End Area Instrument, can offer you 100% electronic inspection of your drill pipe.

See a demonstration of the new end area instrument and Amalog* new pipe inspection at space O.S. 101



- Increase your drilling profits by eliminating defective pipe from your drill string.

Specify Tuboscope SONOSCOPE® with the new End Area Instrument for your next drill pipe inspection.

TUBOSCOPE COMPANY

2919 HOLMES ROAD • HOUSTON, TEXAS

® Service Mark Reg. U.S.A. and Canada

* Service Mark of Tuboscope Company

TUBOSCOPE

Tuboscope COMPANY

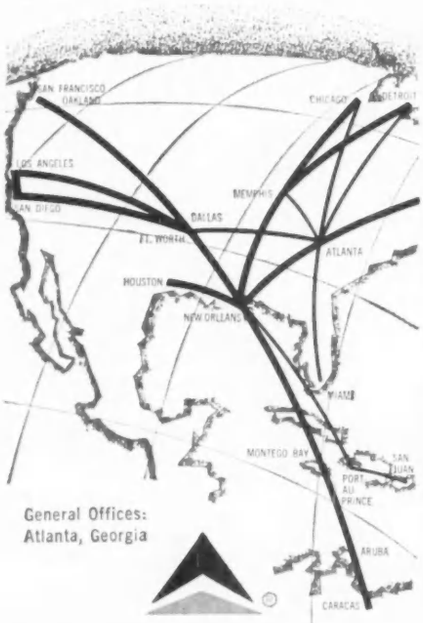
P. O. BOX 808 • PHONE: JAckson 6-4961

Effective Dec. 1st

Delta Jets between Caracas, Jamaica & California

Delta flies the Great Circle Route across the Caribbean to California via New Orleans.

Delta Jets link the major oil centers of both Americas. Now fly Delta's through jet service from Los Angeles and San Francisco to Texas, New Orleans and on to Montego Bay and Caracas. Also conveniently scheduled DC-7 service south from New Orleans. All flights offer Royal Deluxe or economy tourist service.



General Offices:
Atlanta, Georgia

DELTA
AIR LINES
FROM CALIFORNIA TO THE CARIBBEAN

Suppliers' notes

Otis Engineers Receive Awards

Four employes of Otis Engineering Corp., Dallas, received 25-year awards at a recent meeting. They are: Lowell M. Wilhoit, vice president of engineering, Harry A. Wyckoff, Jr., manager of tubing operations, George E. Hamic, Jr., night production superintendent, and Earl S. Brown, packer salesman. Shown above are H. C. Otis, Jr., senior vice president, Brown, Hamic, H. C. Otis, Sr. chairman of the board, Wyckoff, Wilhoit, and Robert H. McLemore, president.

John P. Cartwright has become vice president of the Machinery Group of **Dresser Industries, Inc.** He had been vice president and general manager of the industrial division of Joy Manufacturing Company after serving in various executive sales capacities at Joy.

J. P. Cartwright

W. L. Phillips

Atlas Bradford Company has appointed three new district sales managers. **L. T. Shackelford** is Houston district sales manager, and **W. L. (Bill) Phillips** and **Roger E. Bartelsmeyer** will head the Louisiana-Mississippi and West Texas districts, headquartered at Lafayette, La. and Odessa, Texas, respectively.

Charles H. Weier has been elected financial vice president and secretary of **Camco, Inc.,** in Houston. Weier is a University of Wisconsin graduate and a CPA. He was formerly associated with Mortgage Associates, Inc. of Milwaukee.

Worthington Corporation, Harrison, N. J. announces two new appointments. **Raymond E. Young,** formerly internal auditing manager, is now acting comptroller of the firm. **Vincent deP. Gerbereux** has been named marketing services director. He formerly managed Worthington's Standard Pump Division at East Orange.

Travis W. Brown has been named field operations manager for **Geolograph Service Corporation.** He will direct operations of the firm's 19 district offices from its Oklahoma City headquarters.

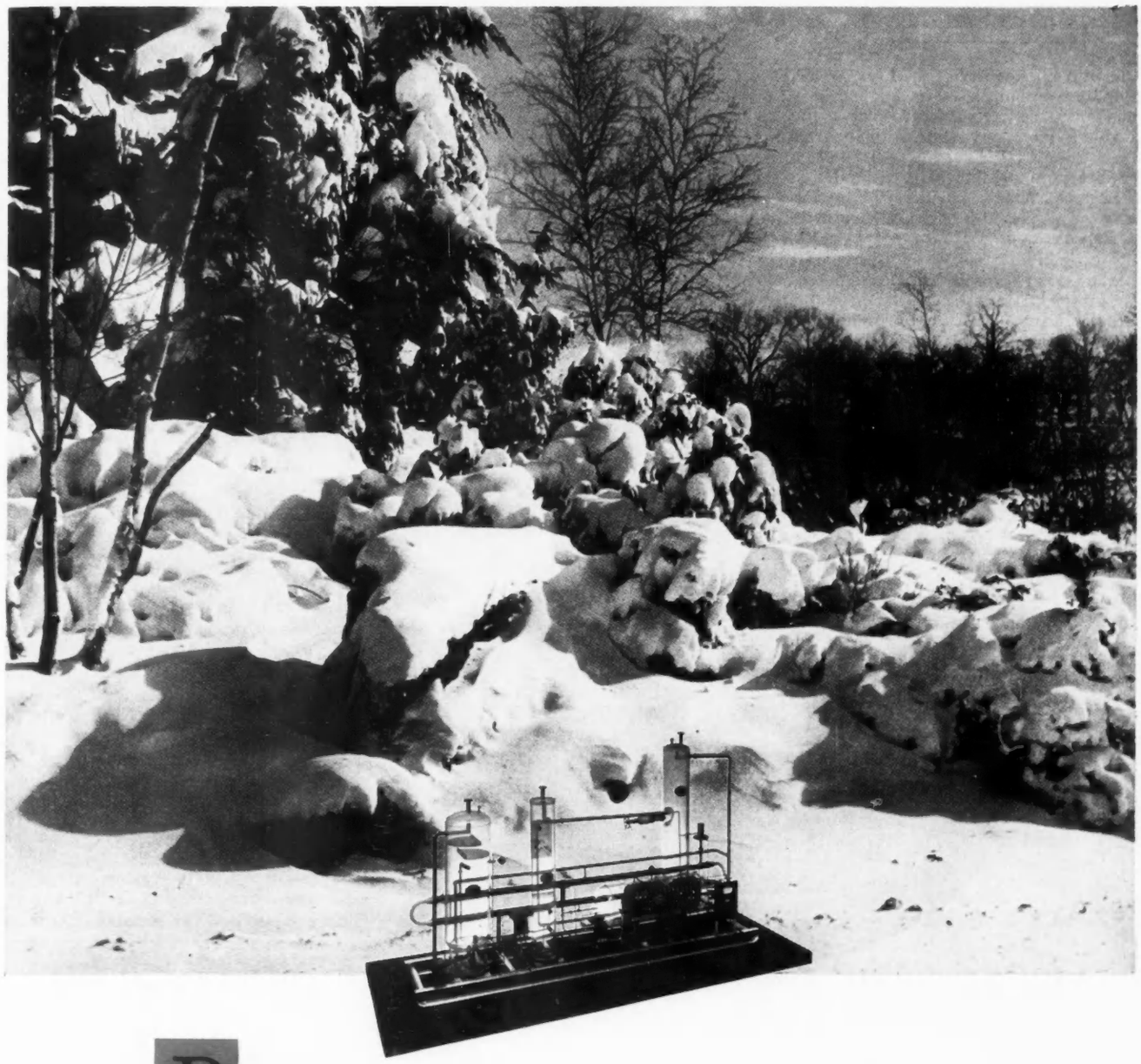
Recent personnel changes at **Dowell Division, Dow Chemical Company** include transfer of **William M. Ross, Jr.,** petroleum engineer at Hobbs, N. M., to Tulsa; appointment of **Thomas R. Harrison** to treasurer of the division, in Tulsa; naming of **Ralph H. Smith** as board member and vice president of Dowell Division; promotion of **J. H. Hanes** to assistant secretary and of **Donald E. Griffith** to assistant treasurer of the same division. Also, **J. I. (Jimmie) Matthews** has become audit supervisor.

Jones and Laughlin Supply Division has announced three new appointments. District store managers are **Julius Nemeth** at Morgan City, Louisiana, and **W. H. Seeker, Jr.,** at Hobbs, N. M. Nemeth was salesman at Harvey, La., and Seeker was formerly store manager at Snyder, Texas. **Haney Atyia,** salesman at Midland, Texas, is the newly-appointed Snyder store manager.

Paul Hunnicutt has been named public and personnel relations manager, **Halliburton Company,** Duncan, Okla. He first worked for Halliburton in the firm's Duncan shops in 1936.

Orville R. Mertz, financial vice president and treasurer of **Koehring Company,** Milwaukee has been elected to the firm's board of directors. Mertz was with Ford Motor Company as a division controller before joining Koehring in 1953.

R. L. Hanes has been appointed vice president of sales for the Western Division of **The Colorado Fuel and Iron Corporation.**



PERPETUAL WINTER It is always winter in the separation vessel of a Parkersburg HYRECO* Low Temperature Separation Unit. Chilled by the natural refrigeration of expanding gas, most of the water vapor and liquefiable hydrocarbons are efficiently removed from the well flow stream — automatically and with minimum attendance.

The **exclusive** Parkersburg "T-Bone" cold separation vessel combines the good points of vertical and horizontal vessels. The gas is dehydrated to better than pipeline specifications and a greater volume of salable condensate is recovered than is possible with conventional separation. As a matter of fact, the additional hydrocarbon recovery will usually pay out the unit in a short time.

Wherever there is oil and gas, there is a Parkersburg man. Call him for all the equipment you need from Wellhead to Pipeline.

Ask your Parkersburg Representative for the full story.

Parkersburg

Division of Parkersburg-Aetna Corp.

HOUSTON • COFFEYVILLE • PARKERSBURG

*PARKERSBURG Trademark Patented

For more data on advertised products, use cards, last page.

Suppliers' notes

George H. Loeffler and **M. L. Wheat** have been appointed sales engineers in the Houston office of **Grove Valve and Regulator Company,** subsidiary of Walworth Company. Wheat has 13 years of experience in manufacture and sales of oil field equipment. Loeffler will specialize in valve sales and refining-petrochemicals applications.

John W. Thornton has been elected vice president, Industrial Division of **Joy Manufacturing Company.** He joined Joy in 1957 and was vice president for marketing before attaining his new post.

H. G. Bentson

F. E. Siever

F. E. (Ed) Siever has been named vice president of domestic sales (including Canada and Alaska) and **H. G. (Hal) Bentson,** vice president of export and industrial sales, of **Smith Tool Co., a division of Smith Industries International, Inc.**

Donald W. Waack is the new sales promotion manager at **Bucyrus-Erie Company,** South Milwaukee, Wis. He had previously been a sales manager with an equipment firm in Waverly, Iowa.

H. E. Collins has been named licensee manufacturing services director of **Hughes Tool Company.** He has been with Hughes since 1919. Prior to his new appointment he served as overseas manufacturing manager.

Another new appointment at **Guiberson Corporation** is **Hal Messinger,** director of marketing. Messinger has long experience in sales work with several oil field supply firms. He will direct Guiberson's entire domestic and foreign marketing and sales program.

The Tubular Products Division, **Jones and Laughlin Supply Division** announced in Tulsa the appointment of **E. F. Westhoff** as assistant to the merchandise manager, tubular products; and of **B. F. Harrod** to chief clerk, tubular products. Westhoff has been with J & L since 1936, and Harrod joined the firm in 1951.

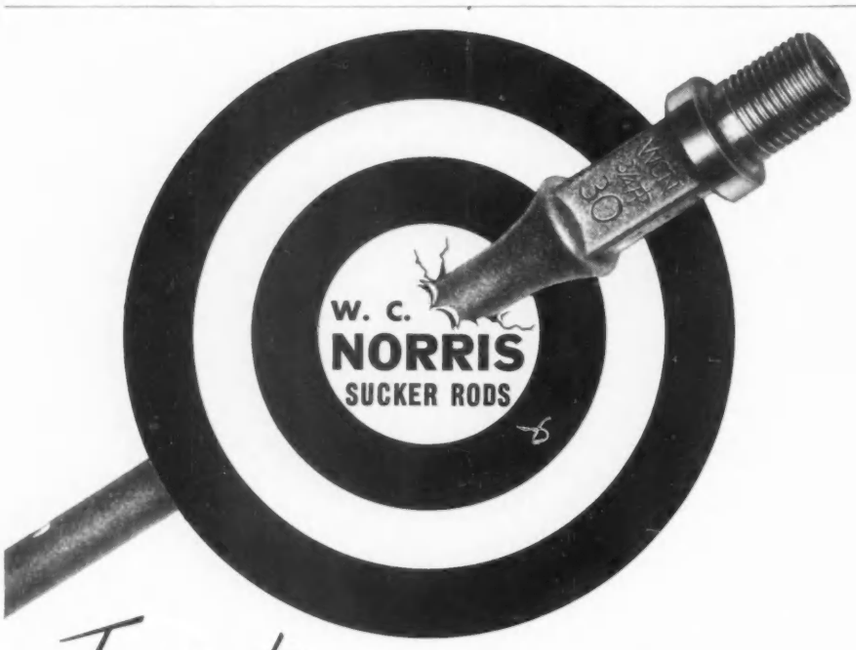
In the Production Equipment Sales Section of J & L in Tulsa, **James A. Bailey** has been named sales supervisor-LACT.

Tuboscope Company has opened a new inspection division at Graham, Texas, supervised by **Wendell Harrison.** He was previously production manager at Odessa. Another new Tuboscope inspection division is located at Carmi, Illinois. It is managed by **C. E. Shake,** formerly Houma, Louisiana division manager.

Rodman Supply Company opened a new store at Perryton, Texas, to augment service in the Texas and Oklahoma Panhandles and southern Kansas. The Perryton facility will be supervised by **M. Q. Wilson,** district manager, who will continue to office in Pampa, Texas.

Southwest Industries, Inc. of Houston has become exclusive distributor for turbocharger equipment made by **AiResearch Industrial Division** of **The Garrett Corporation.** Southwest will handle sales and installation of turbochargers for two-cycle natural gas engines in Texas, New Mexico, Colorado, Nebraska, Kansas, Oklahoma, Louisiana, Mississippi, Alabama, Arkansas, Missouri and Illinois.

Johnny Wall has been appointed service manager for **Pressure Services, Inc.,** in Dallas. Wall will be in charge of all of PSI pipe snubbing operations.



Target **Longer Service**

TYPE 30 — Carbon-Manganese fully normalized. For heavy duty where corrosion is not a major problem.

TYPE 75 — Nickel-Chromium-Molybdenum Steel, normalized and tempered. For extremely heavy duty in medium corrosive fluids.

TYPE 40 — Nickel-Molybdenum Alloy. Normalized and tempered. For heavy duty pumping in medium corrosive conditions.

TYPE 78 — Carbon-Chromium-Molybdenum Boron Alloy, normalized and tempered. For heavy duty pumping in non-corrosive or inhibited fluids.

Write for prices and complete literature today!

BUY FROM YOUR NORRIS DISTRIBUTOR

NORRIS QUALITY
SUCKER RODS
POLISHED RODS COUPLINGS

W. C. NORRIS DIVISION
DOVER CORPORATION
P. O. BOX 1739 • TULSA, OKLA.
BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

Every time this little disc pops it saves you important money!

This is a stainless steel rupture disc for the UNIBOLT Pressurematic Valve. When it breaks it costs you a few dollars . . . but it could save you thousands of dollars in wasted production or damaged surface equipment.

The UNIBOLT Pressurematic Valve — unlike any other high/low safety valve — employs a balanced piston design, i.e., a small piston exposed to high pressure (well head) is balanced against a large piston exposed to low pressure (flow line). When the flow line pressure is increased or decreased beyond a predetermined point, the Pressurematic Valve closes instantly, automatically.

For example, a broken flow line would lower the pressure under the large piston and the valve would close. Hydrate freezing or a closed valve, for example, would increase the flow line pressure. But before this pressure build-up could burst the flow line or blow up other low pressure surface equipment a rupture disc in the Pressurematic Valve would pop, causing the pressure under the large piston to drop and, again, the valve would close.

So, as long as the rupture disc in your Pressurematic Valve doesn't pop, your well and your surface equipment have the finest protection available against numerous field hazards. And when it does pop, you've spent a few dollars to save many!

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

STRATA-FACTS

ON OIL WELL CEMENTING

How to Get Better Fill-Up at Lower Cost

Lightweight slurries using Strata-Crete 6 give greater fill-up per dollar than any other cement additive.

Check the chart below, and compare the figures with your own cementing costs. Strata-Crete 6 high performance value comes from excellent bridging properties—higher than any other commercially available cement additive.

Strata-Crete 6 slurries are light in weight. They are easily placed at normal pump pressures.

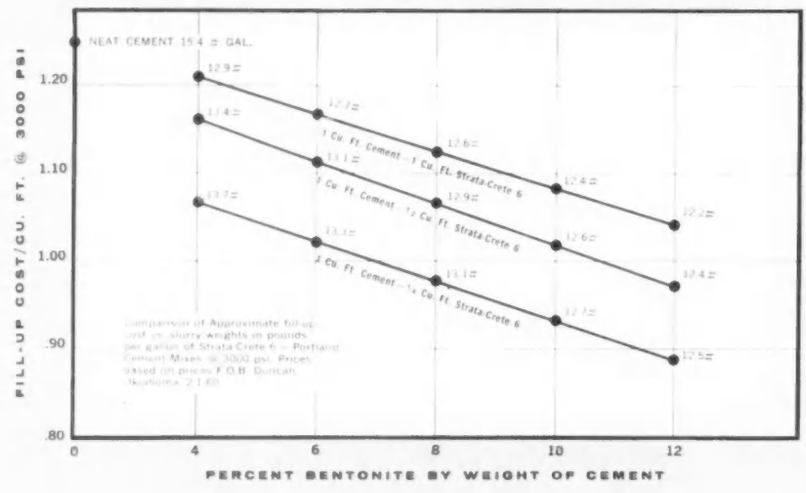
ADDED BENEFITS

Strata-Crete 6 also provides other important cementing advantages.

Chief among them are:

- **Good formation bond.**
- **Good early strength** which allows for prompt perforating and completion without long delays.
- **Excellent perforating properties** through added resilience—this permits maximum perforating effect with practically no cracking or shattering of the cement sheath.

Ask your cementing company to deliver you a Strata-Crete 6 cement job. Or write to Strata-Products Department at the address below.



Strata-Crete 6®

STRATA PRODUCTS DEPT., GREAT LAKES CARBON CORPORATION
1404 Neils Esperson Building, 804 Travis, Houston, Texas

Suppliers' notes

Arch H. Rowan, Jr., has been elected president of **Fire Control Engineering Co.** of Fort Worth and remains a director.

Arch Rowan, Jr.

W. E. Lloyd

Wendle E. Lloyd has been named executive vice president of **Wheel Trueing Tool Company's** newly acquired subsidiary, **Drilling & Service, Inc.,** Dallas.

Leyland Motors Group Moves Into Portugal

Further expanding its worldwide marketing and manufacturing organization, the Leyland Motors Group has formed a company in Portugal to assemble and eventually manufacture Leyland trucks, buses and diesel engines.

Known as Leyland Portuguesa Ltda., the new company has been formed in association with Francisco Garcia et Cia Ltda., Leyland's former Portuguese distributors. A plant at Setubal, 20 miles south of Lisbon, is due to be in operation in October.

Grove Company Mexican Plant Begins Production

Grove Valve and Regulator Company, a subsidiary of **Walworth Company,** has started full-scale production at its new valve manufacturing plant in Mexico.

The new facility, located near Mexico City, is capable of supplying all major oil and gas pipe line valve requirements in Mexico.

The new plant is equipped to manufacture the full line of Grove G-4 gate valves up to 36 inches in diameter.

Baker Oil Tools, Inc., Constructs Laboratory

Baker Oil Tools, Inc., has completed the construction of a new 9,000-square foot Engineering and Research Laboratory at the site of its Houston Manufacturing plant. Although not completely equipped, the laboratory is in operation providing an important expanded research and quality control testing facility.

The laboratory was designed to enable engineers to accurately simulate current and future field operating conditions—pressures in excess of 20,000 psi at temperatures in the vicinity of 1,000° F.

For more data on advertised products, use cards, last page.

XP-20/Spersene mud systems are so simple, yet they can do what other muds have tried to do for years

In spite of this simplicity, XP-20/Spersene muds are unusually stable under high temperatures and high pressures. They have outstanding filtration characteristics. They retard the natural swelling of solids. They have excellent tolerance for contaminants. XP-20/Spersene muds do what other muds have tried to do for years, and at much less cost.

Magcobar
Complete
DRILLING MUD SERVICE

DRESSER INDUSTRIES, INC.
OIL • GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL

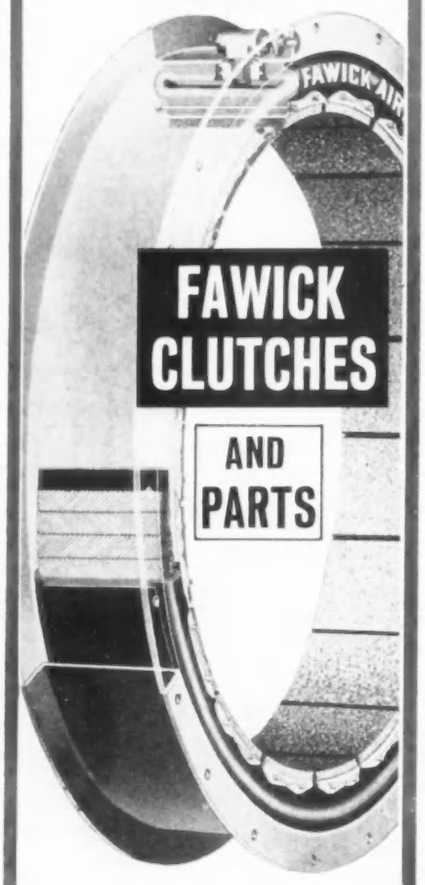
MAGNET COVE BARIUM CORPORATION / HOUSTON, TEXAS

For more data on advertised products, use cards, last page.

CALL

MID-CONTINENT

FOR



SURE SERVICE — SURE SUPPLY

MC2-1

MID-CONTINENT
SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT
OIL FIELD SUPPLY COMPANY

Mid-Continent Building, Fort Worth, Texas
Export Division: 45 Rockefeller Plaza,
New York 20, N.Y. Cable: MIDCUMPORT NYK

SQUEAKS

From the Bull Wheel

"Wait!—I thought you said this was a 'DRY' hole!"

A Cock and Bull Story

When the Sunday school teacher asked: "Why did Noah take two of each kind of animal into the ark?

To which one bright youngster answered: "Because he didn't believe that story about the stork."

Pent Up In a Penthouse

First girl, reminiscing about the penthouse party:

"He insisted on petting and I pretended to enjoy it until I had two highballs."

Second girl. "By then I guess you got up the courage to tell him off."

First girl. "By that time I really got to enjoying it."

Top of the Stairs

Work hard for eight hours a day, don't worry and in time you may come to own the business, become the boss, work 18 hours a day and have all the worry.

Tied to Strings

Father at the top of the stairs: "You down there, do you think you can stay here all night?"

Young man: "I'm not sure, sir, I'll have to call my mother and find out."

A New Sales Pitch

In a desperate effort to halt a sagging sales curve, the manager called a meeting of all salesmen and asked each to bring his wife. After dwelling for 30 minutes on the role the wife can play by encouraging her husband, he singled out one of the younger women and asked:

"Now, tell us what do you do to encourage your husband?"

"Oh, I couldn't," she protested, "not in front of all these people."

Old Roman Patriots

Teacher: "Name two ancient sports."

Pupil: "Anthony and Cleopatra."

To Be Sure

Lover boy: "How about some old-fashioned loving?"

Girl friend: "Sure thing. I'll call grandma."

Same Old 6-and-7

Friend: "How do you like married life?"

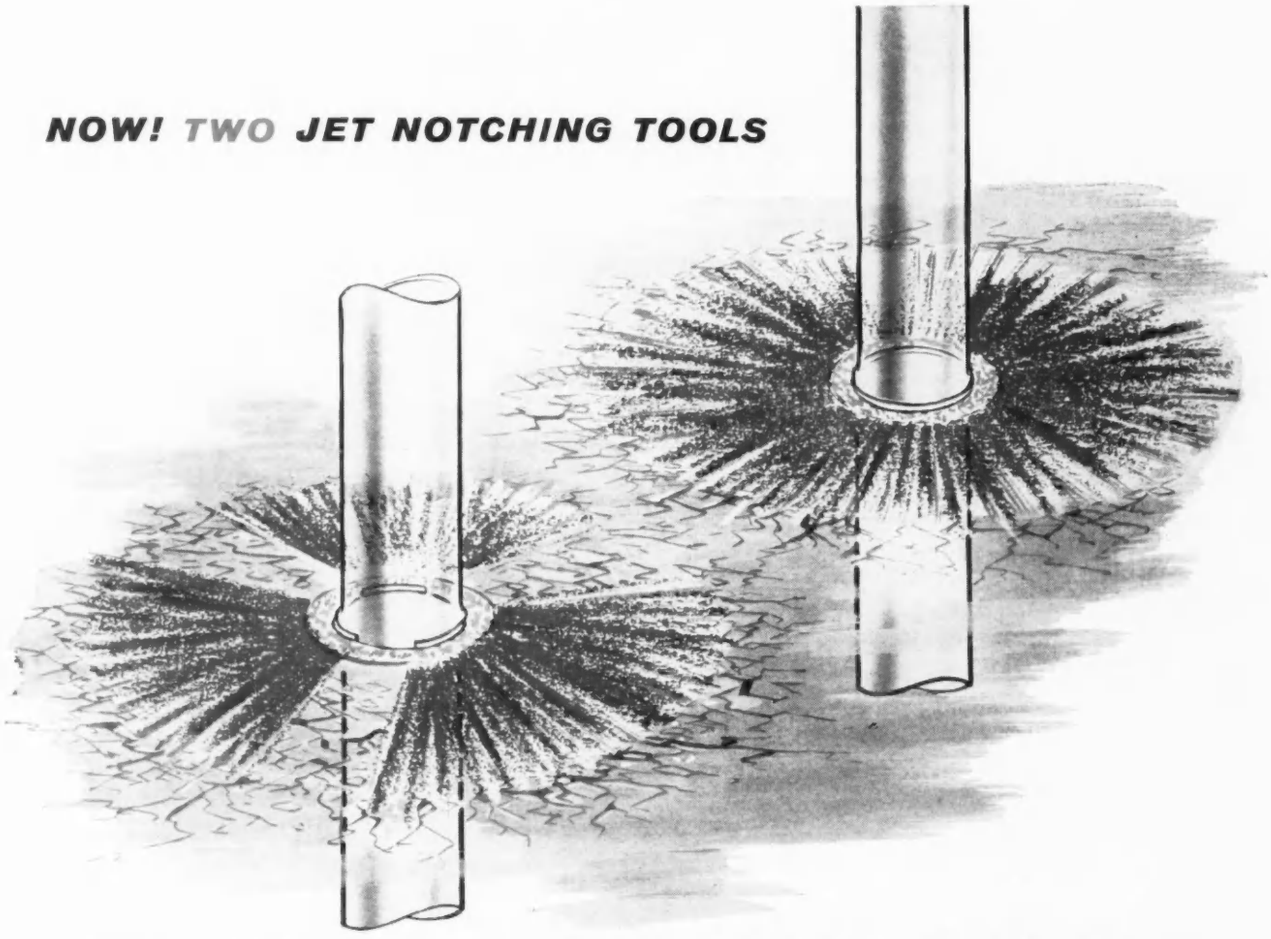
New bride: "To tell the truth, I can't see any difference."

Home Sweet Home

"What's a home without a mother?"

"Well, it would be a good place to bring your girl friend."

NOW! TWO JET NOTCHING TOOLS



McCULLOUGH FRAC-NOTCH CUTTER AND NEW TRIPLE FRAC-NOTCH CUTTER

McCullough's new Triple Frac-Notch Cutter, companion tool to the widely used Frac-Notch Cutter, is gaining extra production for operators wherever hydraulic fracturing is required for well completion or stimulation.

Where the Frac-Notch Cutter produces a full circle, horizontal notch around the well bore, the new Triple Frac-Notch Cutter makes three separate notch cuts simultaneously at the same depth in the well, on a single run. Each notch cuts through casing and cement and cuts and fractures as much as 15″ into the formation. *A segment of uncut casing is left between each notch.* When hydraulic pressure is applied the formation is fractured between each notch, giving the effect of full-circle fracturing.

The McCullough notching process is the most effective of all single-point entry methods of fracture initiation. The enormous power of the cutting process notches into the formation and also fractures the formation for some distance beyond the face of the actual cut. Thus, lower hydraulic fracturing pressure is required for initial breakdown, a greater area of formation is more effectively fractured and the flow capacity of the treated formation is greatly increased.

Check with your nearest McCullough Service Location! This process can gain you substantial production increases.

Sizes available for: 4½″, 4¾″, 5″, 5½″, 5¾″, 6⅝″ and 7″ OD casing. (The Frac-Notch Cutter is also available for 2″, 2½″, 3″ and 3½″ tubing.)

UP TO 100 TIMES MORE EFFECTIVE FRACTURING POWER

CAN IMPROVE PRODUCTION AS MUCH AS 30 TIMES

REQUIRES LESS RIG TIME

ACCURATE PLACEMENT OF NOTCH

VERY ECONOMICAL

McCullough

TOOL COMPANY

Los Angeles • Houston • Edmonton

Cable Address: MACTOOL

For more data on advertised products, use cards, last page.

Today, electronic answers for your cut-off

1. When is the right time to cut the right length of rope? With Union's new electronic brain calculations you don't have to guess—you **know** exactly the maximum safe service to expect. It took 462 charts and more than 600,000 calculations, but oilfield wire rope cut-off procedures now are scientifically based. Union's Tuffy has figured it all out on the IBM "705" electronic brain.

2. Union's staff of trained engineers goes to work on your problem at once. All variables are considered — drum diameters, derrick heights, drill collar and pipe sizes, rope diameters, design

How would you like to use the same magic brain that it takes to get missiles and rockets off the launching pad to solve *your* Cut-Off Procedure problems on your next drilling job? Now you *can*—and Union Wire Rope brings you this million dollar service free. We have over 600,000 electronic calculations to make ton-mile charts—charts that tell you the proper length and time to cut rope for maximum safe service for any drilling operation anywhere in the world.

Try this new Electronic Cut-Off Procedure on your next job. And be sure you specify Union Tuffy Standard Rotary Line, Union Tuffy Jackknife Rotary Line and the Standard Union Oil Well Servicing Ropes. The best costs less on the long haul. For quick delivery, call your oil field supply store.

ff procedures are as quick as 1-2-3!

factors, mud or air drilling, etc. It's all charted—a total of 118,360 different answers! Our engineers select from the master book the ones that apply to **your** job. There is no guess work involved.

3. **The answer to your cut-off procedure problem** is rushed to you by our Union fieldman. So far as you're concerned the rest is easy. Only 5 or 6 simple charts usually is all that's required. Our fieldman will explain their use to you and your crew, all without cost. And he'll check back regularly with you to assure maximum safe service all the way. For more information and booklet on Cut-Off Procedures, contact **Union Wire Rope, Armco Steel CORPORATION, 2104 Manchester Ave., Kansas City 26, Mo.**

ARMCO **Union Wire Rope**

PLASTIC COATINGS
Epoxy-Phenolic
Polyurethane-Thermosetting

CRALL does it again! Automatic Sand Blasting and Plastic Coating, Multi-Coat, Multi-Bake of PLAIN and SCRAPERED Rods and Fittings for Paraffin and Corrosion control.

With AUTOMATION . . . press a button, Rods Rotated and Passed through Sand Blaster and Plastic Coating Machine Automatically . . . 100 ft. every 2½ minutes. Plastic Coated evenly and perfectly . Multi-Baked in Controlled Ovens in the 400° range.

CRALL IS THE ONLY PLANT IN THE WORLD ENGINEERED FOR AUTOMATION PLASTIC-COATING OF PLAIN SUCKER RODS AND SCRAPERED RODS.

CRALL PRODUCTS, INC.
P. O. BOX 1640 • PAMPA, TEXAS

SOLD THROUGH YOUR FAVORITE SUPPLY STORE
Sales Offices & Plants in Principal Oil Centers

Dallas • Odessa • Midland • Wichita Falls • Tulsa
Oklahoma City • Russell • Wichita • Shreveport
Farmington • Denver • Mt. Vernon, Ill. • Casper
Edmonton • Calgary

WORLD OIL'S **Trading Post**
CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) **set** in this size type: 20 cents per word. Minimum charge $4. Blind box address in our care counts six words. Replies forwarded without charge. **Display Classified ads,** set in suitably larger type with ruled border, $13.50 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All Classified ads payable in advance.** Copy deadline: Twelfth of month preceeding date of issue. Send copy and checks to: Trading Post Classified Section, World Oil, P. O. Box 2608, Houston 1, Texas.

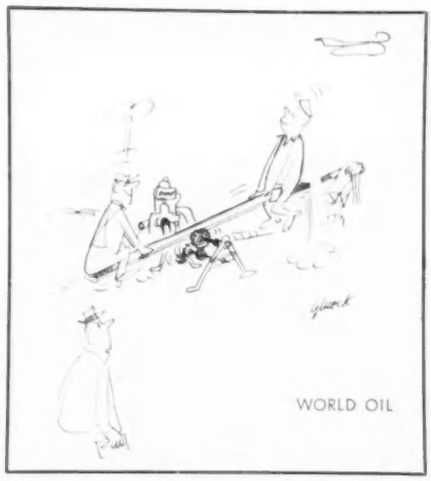
INVESTMENTS

■ FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

Manuscripts Wanted

Have you written a book you would like to have published? Do you have an idea or an outline that you would like to talk over with a publisher? Gulf Publishing Company, publishers of World Oil, Petroleum Refiner and Pipe Line Industry magazines, and numerous technical books, is actively seeking trade and technical manuscripts for publication by its rapidly expanding Book Division. For further information write to Manager, Book Publishing, Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas.

Squeaks



"Say . . . are you guys sure you sent that regular pump in for repairs?"

One Track Mind

A clerk at one of the state library commissions received this request: "Please send me 'Childbirth Without Fear.' If you can't do that, send me the 'Gathering Storm'."

An Adult Western

Excited scientist watching microbes through the microscope: "Here come the good guys! Here come the good guys!"

Man Wanted Department

Sailor, walking into recruiting office, "Gimme that ol' sales talk again. I'm gettin' kinda discouraged."

Word Travels Fast

She: "Do you know what they are saying about me?"

He: "Why do you think I'm here."

Business Before Pleasure

Absent-minded sales girl as her date kissed her good night:

"Will that be all?"

A Greeting Card

"Dear Mom and Dad," a young college student wrote home to his family. "I haven't heard from you in nearly a month. Please send a check so I'll know you're all right."

It's Later Than You Think

It's a great life if you weaken enough to enjoy it.

A Short Circuit

Mary: "I'm surprised at you, Joan, fighting with the boy friend like that. I always believed that you were very much in love with him."

Joan: "He's a perfect imbecile. Last night I purposely shorted the lighting system, and the idiot spent till nearly daylight looking for the short."

Famous Epitaphs

Bopster: "Don't Dig Me Man—I'm Gone."

Hypochondriac: "I told you I was sick."

Love and Marriage

The honeymoon is really over when he phones to say he'll be late for dinner—and she's already left a note saying it's in the refrigerator.

Deficit Spending

A friend being questioned by his psychiatrist sought the answer to his problem.

Psychiatrist: "What kind of car do you drive?"

Patient: 'A new Caddy."

Psychiatrist: "Where do you live and where do you vacation?"

Patient: " Live in a $100,000 mansion and go to Florida for six months a year."

Psychiatrist: "With all that, what's your problem?"

Patient: "I only make $75 a week."

From One Mouse to Another

Two mice were talking. One said, "I'm going up in those satellites with the monkeys."

Mouse number two: "Isn't that dangerous work?"

Mouse number one: "You want I should go back into cancer research?"

It Takes Two to Tango

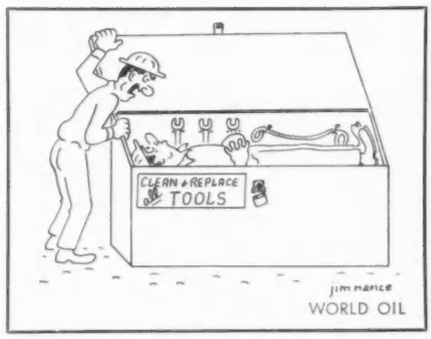
Two girls were walking along the street, followed closely by a lone sailor. Finally one of the girls turned around angrily.

"Now, look here," she demanded, "you either quit following us or get another sailor."

A Beautiful Friendship

Warden: "Tomorrow you'll be honored by having the Governor of the State in your very cell."

Inmate: "Zat so? It's about time they had that scoundrel in jail."



"Having trouble finding that wrench?"

SECONDARY RECOVERY

PETROLEUM ENGINEERS
STEPHENS ENGINEERING
WICHITA FALLS, TEXAS

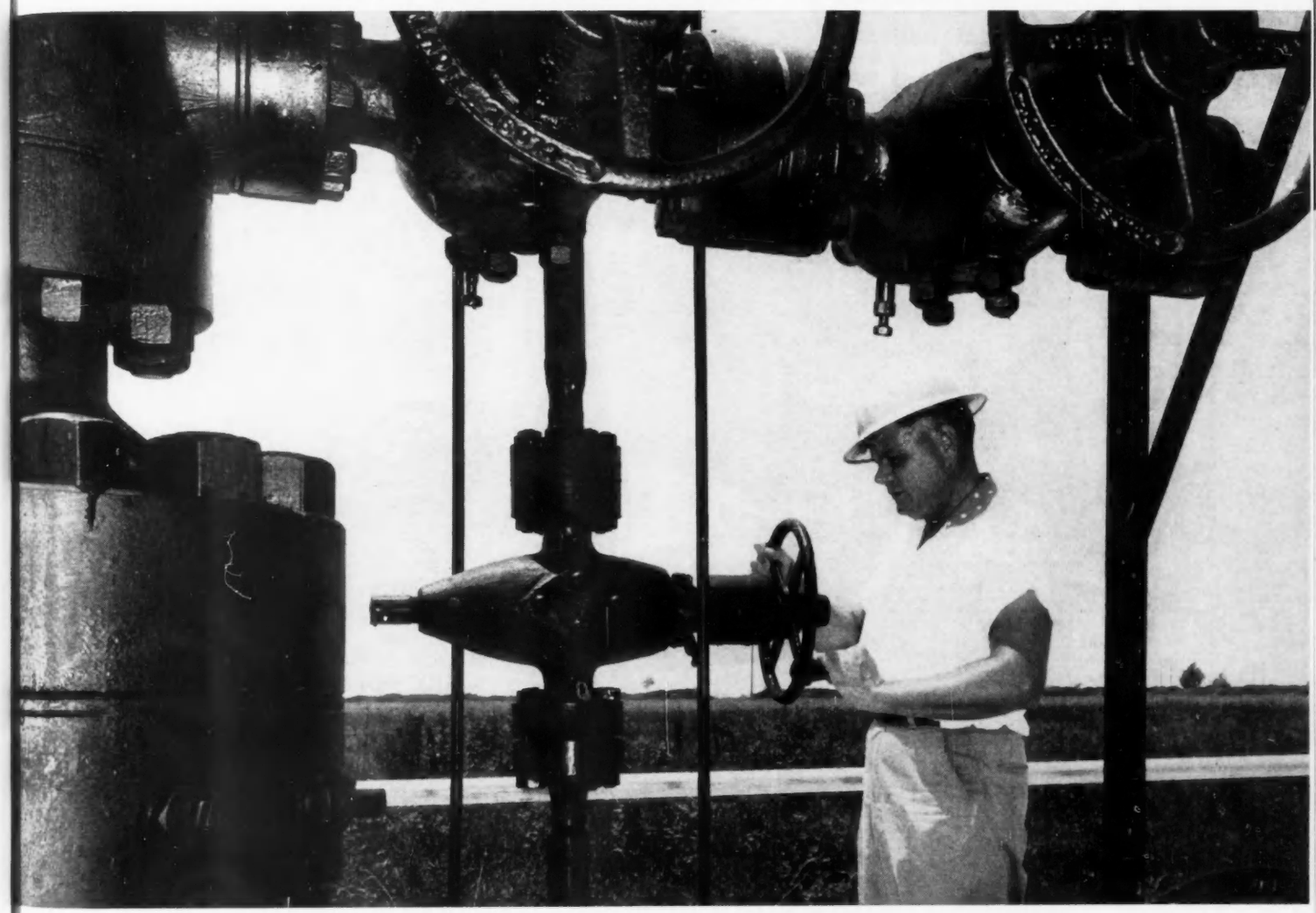
RESERVOIR ENGINEERING
Water Flooding Gas Repressuring
EVALUATION CORE ANALYSIS
SURVEYS ECONOMICS
Cost Estimates, Design, Installation
FIELD SUPERVISION
Phone 723-2167

The Most Efficient, High Pressure Valve Ever Made

W-K-M BALANCED STEM GATE VALVE

The W-K-M Balanced Stem Gate Valve, built to control well pressures up to 20,000 psi, uses the unique and proved parallel-expanding gate principle. A balancing stem permits easy spin-open, spin-shut operation. Turning the handwheel exerts tremendous sealing force at both upstream and downstream seats with positive mechanical sealing in both open and closed positions. Superior performance on highest-pressure wells has made W-K-M Gate Valves the standard of excellence the world around. Futhermore, as added proof, this valve successfully completed "tests more severe than ever attempted on similar equipment" by an independent laboratory. For full information send for bulletin WP 1157 and a copy of "The Crookston Report." . . . P. O. Box 2117, Houston 1, Texas.

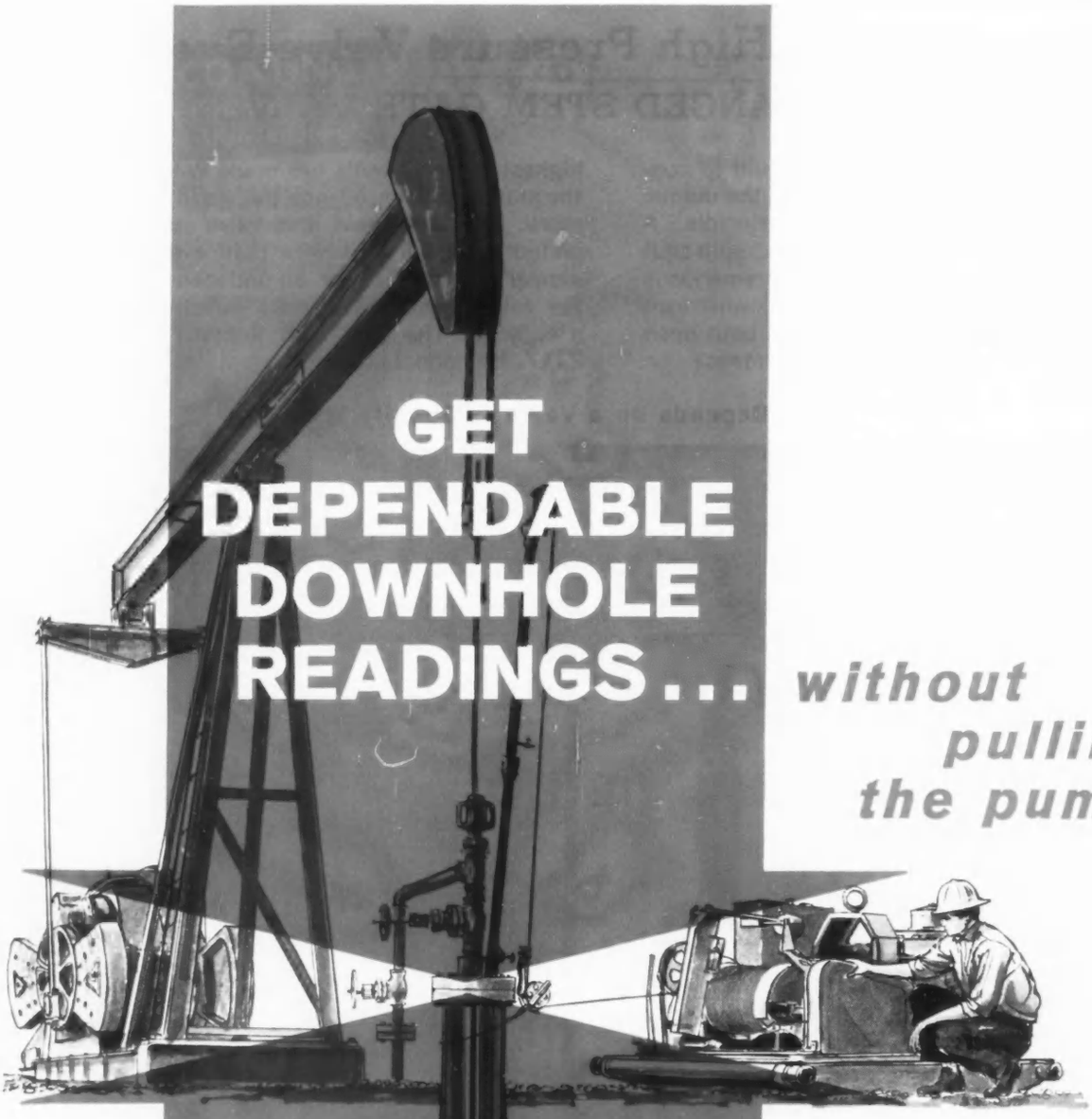
When So Much Depends on a Valve . . . Specify W-K-M.



W-K-M
DIVISION

ACF INDUSTRIES

P. O. BOX 2117 HOUSTON, TEXAS



GET DEPENDABLE DOWNHOLE READINGS... *without pulling the pump*

A major oil company had a reservoir engineering problem. Downhole temperature and pressure readings of a pumping lease were needed to help determine required production stimulation and/or pumping rate modifications to maintain the best production rate from the field.

Facing the task of pulling the pump from each well to obtain this data, the producer asked Halliburton to design a Measuring Reel with which they could run bottom hole instruments in the annular space between tubing and casing without fouling the instruments down hole.

The answer was the Halliburton Fluid-Drive Reel Measuring Assembly, with a built-in torque cushion. This gives advance indication of hanging the line and reduces the hazard of pulling it in two when the tool or instrument wraps around the tubing or hangs up when coming out of the cased well or open hole.

HERE'S HOW IT WORKS

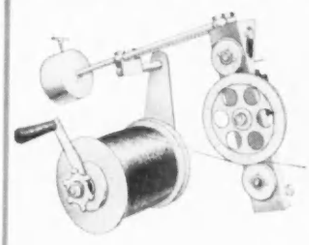
The Hydraulic Fluid-Drive Reel Assembly is driven by a hydraulic motor, powered from an engine-driven pump. A fluid by-pass, running parallel to the hydraulic system, incorporates a needle valve which may be preset to a specific shut-down pressure. If excessive loading of the wire line occurs, such as when the line wraps around tubing, the needle valve causes the pump to stall out and act as a hydraulic brake on the driving motor. This unique system gives a more accurate control of the speed and line pull of the measuring line reel going in and coming out of the well. Design flexibility of the Fluid-Drive Measuring Assembly provides for a completely packaged unit powered by gas/gasoline or diesel engines, as well as electric or air motors. Standard reel capacities include 24,000′ of .066″; 20,000′ of .072″; 17,000′ of .082″; 14,000′ of .092″ regular measuring line; or 4,900′ of 9/64″ cable or well shooter line.

BETTER MEASURING EQUIPMENT

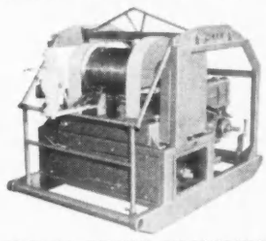
for demanding jobs, such as . . .

- Measuring Top of Cement
- Cable Tool Depth Measure
- Hole Deviation Tests During Drilling
- Reservoir Engineering
- Swabbing and Sand Washing
- Pulling Chokes and Gas Lift Valves
- Dual Zone Rework

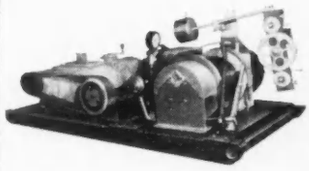
HALLIBURTON MEASURING ASSEMBLIES



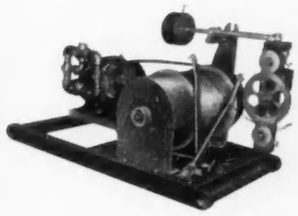
STANDARD MEASURING DEVICE for manual or cathead operation. Available in model shown, or in Heavy Duty type with hand brake.



ENGINE DRIVEN MEASURING ASSEMBLIES are available with diesel and gas/gasoline power in several sizes for light to severe wire line operation.



ELECTRIC MOTOR DRIVEN MEASURING ASSEMBLIES for use where electric power is the most practical application.



AIR MOTOR DRIVEN MEASURING ASSEMBLIES for pneumatic operation off rig air supply.

A FULL LINE OF ACCESSORIES

UNMATCHED MOBILITY can be provided any Halliburton Measuring Assembly with this light, two wheel, metal covered trailer.

LATCH TYPE HAY PULLEY AND LINE WIPER efficiently guides the line into the hole, automatically wiping it free of foreign particles which might damage the line or stuffing box.

STUFFING BOX AND STAFF ASSEMBLY available in models for working pressure of up to 5,000 psi and 15,000 psi.

MEASURING LINES are available in lengths up to 25,000′ in economical Regular Type Black, Galvanized Steel, Nickelply and Stainless Steel. Standard diameters are .066″, .072″, .082″, and .092″.

REPAIR PARTS AND SERVICE are immediately available through all Halliburton Field Locations.

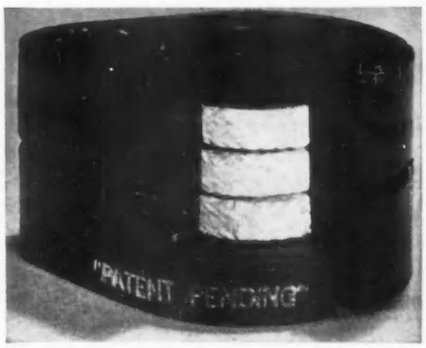
Contact your Halliburton Representative for full details on a Halliburton Measuring Assembly. It can be tailored to your exact needs.

MEASURING EQUIPMENT

275 Service Centers . . . just minutes away from your well!

Halliburton
COMPANY • DUNCAN, OKLAHOMA

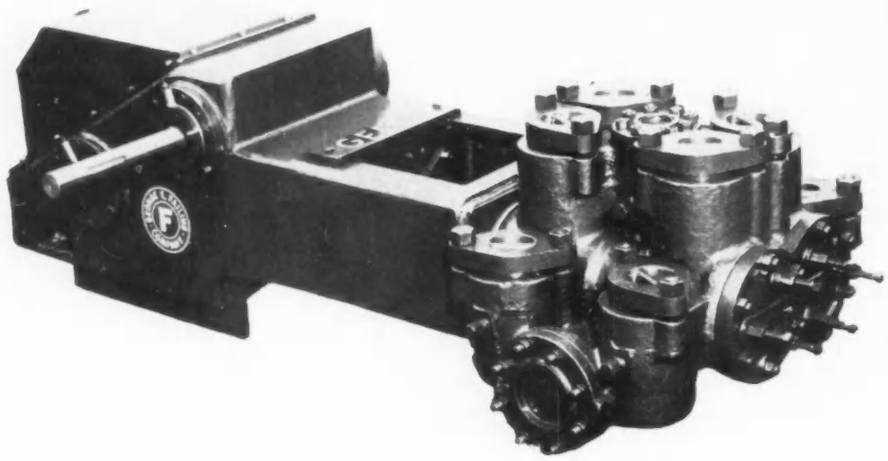
NEW equipment and services



Polished Rod Packing

Teflon impregnated polished rod packing is available for five basic types of stuffing boxes. Packing is resistant to acids, chemicals, produced fluids. Self lubricating feature prevents burning or damage to rod if well pumps off. (R & W Sales).

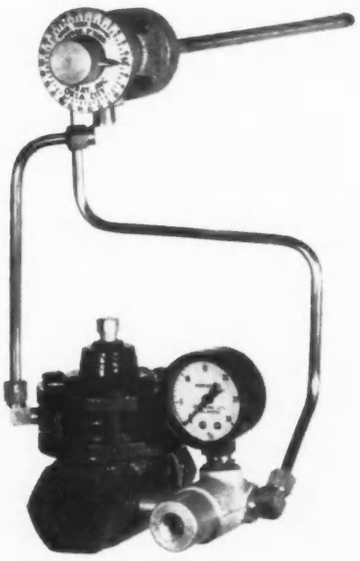
For more data, circle E3 on postcard



Reciprocating Slush Pump

FM-45, 5-inch x 6½-inch duplex reciprocating slush pump has one piece power end with integral eccentric shaft and jack shaft bearing supports. Fluid end is one piece casting with conventional pot valves. Drive power is transmitted by high speed quadruple roller chain. Lubricator packing gland provides positive lubrication to piston rods at points of greatest wear. Connecting rods are one piece steel, with renewable steel backed bushing for eccentric bearings and brass cross head bushings. (George E. Failing Co. Supplements data on pages 1785-1808, 1960-61 Composite Catalog).

For more data, circle E1 on postcard



Heater-Controller

Bi-metal thermostat has complete throttling action for direct fired heaters. Controller consists of spring loaded motor valve with characterized inner valve, sensing element for temperature range of 30-400° F and pop valve to prevent excessive burner manifold pressures. Maximum supply gas pressure—25 psi. Maximum sensing element working pressure with separable socket is 4,000 psi. (Kimray, Inc. Supplements data on pages 3136-3137, 1960-61 Composite Catalog).

For more data, circle E4 on postcard

Tool Joints

Spangweld tool joints have been improved by repositioning hardfaced area to protect tapered shoulder completely against undercutting. Annular band of hard carbide has been extended over the area in which three small pads were formerly spaced 120 degrees apart. Replacement of pads increases hardfacing 45 percent on the shoulders of 4½ inch Spangweld IF tool joints. Shoulder band width has been increased from ⅝-inch to 1-inch on all sizes up to 4½-inches. Total hardfacing band width on tool joints is 3 inches. (National Supply Division Armco Steel Corporation. Supplements data on pages 3849-3976, 1960-61 Composite Catalog).

For more data, circle E2 on postcard

SMG

You reach OIL earlier with
"SALZGITTER"

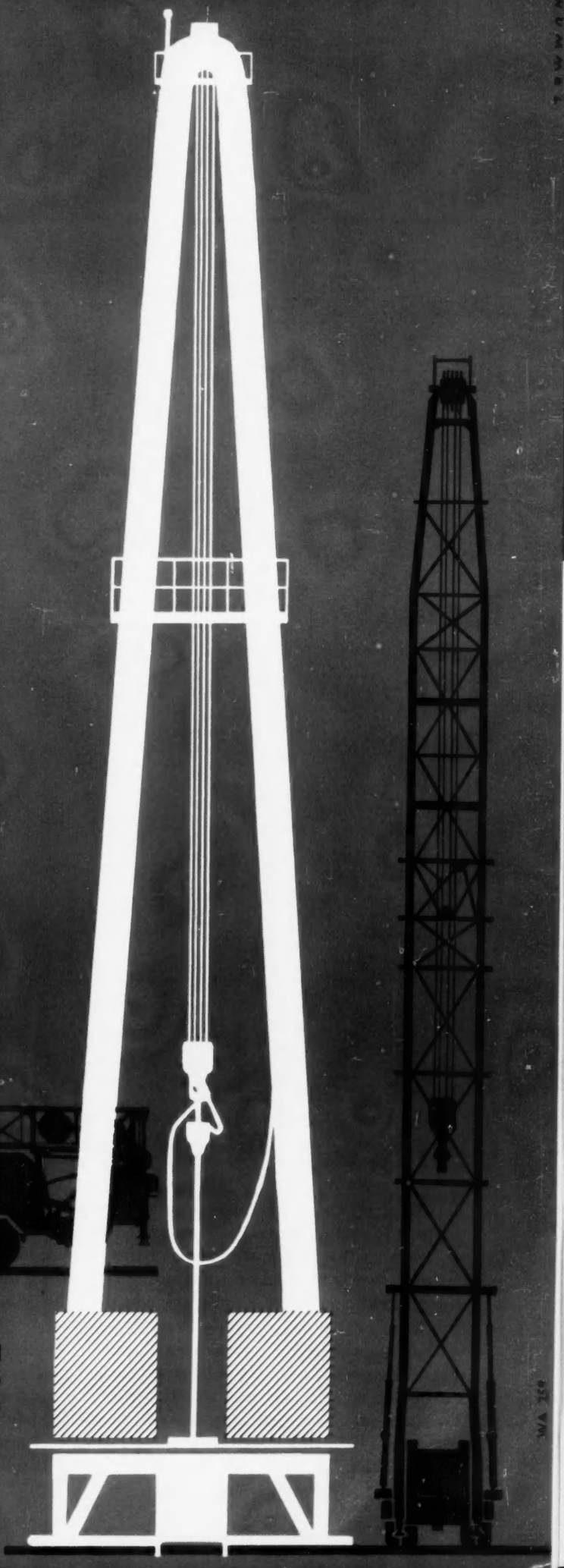
SALZGITTER-Gulliver-Full View-Masts
with max. rated static hook loads API 600.000 lbs. are the sky-scrapers of modern oilfields.

SALZGITTER Trailer-Mounted-Drilling-Rigs
FB 415 for 9.000 ft depths cut erection time. Are ready for drilling in twenty-four hours. Spare drilling costs.

SALZGITTER-Servicing-Units
are quick, economical, and technically up to date. You can put them for workover-, completion, and drilling work.

Oilfield-Engineers like cutting down **transportation and erection time, drilling and production costs.**

Do like them!
Follow the "Salzgitter-Line"



SALZGITTER MASCHINEN
AKTIENGESELLSCHAFT · SALZGITTER-BAD
3441 telex: samag sgtr 0953805 samag

The "OILWELL" string...

PRODUCTS
SERVICES
STORES

Here's why "Oilwell" Century Pumping Units pay dividends

There's always a reason for success. In the case of our Century Pumping Units, the reason is as plain as day: we designed them *after* we surveyed operators to find out what they wanted in pumping units. They asked for dependability, economy, simplicity and safety. We gave it to them in these outstanding Century features:

Their *dependability* comes from the primary structural elements being rigidly welded and perfectly aligned with front samson post legs widely spaced on a solid, T-shaped base. Their *economy* comes from wearing parts engineered for *heavy-duty* service. Their *simplicity* and *convenience* in well servicing comes from an easy-to-roll-back arc with automatic latch, and from a one-piece slant-slot yoke. Ease of care and operation comes from the fact that routine maintenance can be done at ground level. *Safety* comes from the Type G Cranks that make maximum use of counterweights and are easy to adjust with the operator working safely to the side of the unit . . . with lots of toe room between weights and floor.

From design theory to the smallest actual details, Century Pumping Units are the most modern, most efficient available. For full information, write or ask for a free copy of our descriptive booklet 27-61.

USS and "Oilwell" are registered trademarks

The service is great in The Pump Room

It's a different sort of menu than you'll find in Chicago's famous Pump Room, but you can't beat "Oilwell" pump shop service anywhere. Every "Oilwell" pump shop is staffed with specialists who have a background of technical and operating experience. They're there to help you with your pump problems, whether it's pump selection, maintenance, or reworking. On certain pumps, such as SPUN METAL sectional liner subsurface barrels, "Oilwell" offers an *exchange service* that gives you an indentical reworked barrel at less than half its original cost. No matter what your pump problem is, take it to the nearest "Oilwell" pump shop where you'll get the superior service that comes with every "Oilwell" product you buy.

Meet Don O'Bryan

Don is the "Oilwell" store manager in Houston, and he has the background it takes to help you with your problems. He's been with "Oilwell" 28 years, and he knows the oil business inside and out.

Every "Oilwell" store manager is there to see that you get what you need—emergency-fast when necessary. From pumping unit and prime mover to the perforated nipple on the bottom of your tubing string, "Oilwell" stores are stocked with top quality producing equipment in the types and sizes that are locally popular. They carry everything you need from the hundred-and-one fittings, small tools and miscellaneous hardware to flashlight batteries and wiping rags. And store men like Don O'Bryan have access to the knowledge and up-to-the minute information to help you on practically any equipment problem. That's a good reason for stopping by your "Oilwell" store.

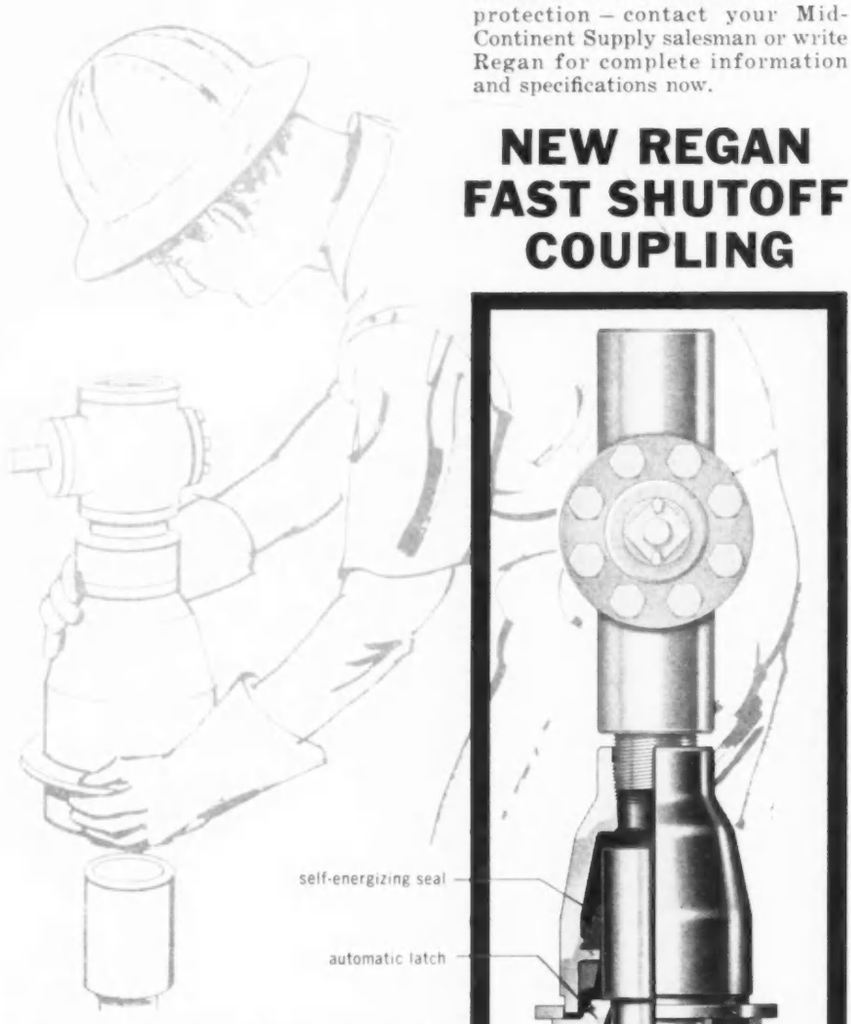
USS Oil Well Supply
Division of
United States Steel

Executive and Export Offices: Dallas, Texas

Lightweight, hand-portable shutoff coupling controls blowing up the tubing quickly, safely

Now, for less than the cost of cleaning up a rig, you can quickly and effectively control the well. The Regan fast shutoff coupling, with a plug valve attached, is kept on the rig floor when running or pulling tubing. If the well starts to blow, the lightweight aluminum alloy coupling is quickly dropped over the top of the tubing string, automatically latching on and sealing off around the tubing collar. A quick turn on the valve and the well is then under control – all handled quickly and easily by one man. Get the facts on this fast new blowout protection – contact your Mid-Continent Supply salesman or write Regan for complete information and specifications now.

NEW REGAN FAST SHUTOFF COUPLING



Ruggedly constructed of aluminum alloy, the new fast shutoff coupling weighs approximately 18 lbs. and can be easily handled by one man. Its action is quick, effective and dependable.

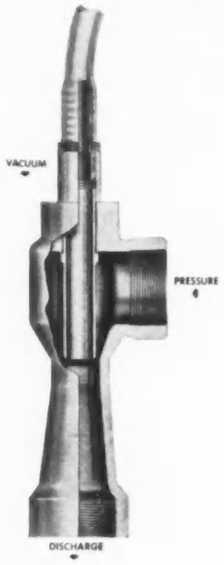
Regan® Forge & Engineering Co.

Quality - Wrought on the Forge of Experience

P. O. BOX 150 SAN PEDRO, CALIF.

Exclusive World Wide Distributors: MID-CONTINENT SUPPLY CO., FT. WORTH, TEXAS

New equipment



Mud Mixer

"Mo-Jet" mixer provides positive method of controlling the amount of product mixed. Unit operates on venturi principle, is self-cleaning since dry material comes through the large suction tube. Unit designed to handle powders or materials which hydrate almost instantaneously on contact with the carrying fluid. Large tube opening prevents plugging, provides full disbursement of powder in fluid. Unit also will perform efficiently in mixing two fluids. (Brine Service Co., Inc.).

For more data, circle E5 on postcard

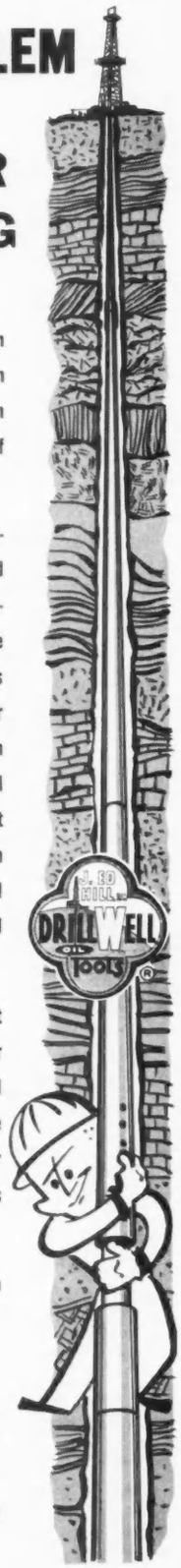
Plug Valve

Permaturn valve utilizes a high lubricity plastic coating that reduces turning, provides lifetime maintenance-free operation. Coating is supplied to tapered surfaces. Teflon coating is used for pressures to 1,000 psi and phosphate-molybdenum disulfide coating is used for high pressure service to 10,000 psi. Both coatings are permanently bonded to the metal surfaces of the tapered plugs. Low pressure valve also features a fixed adjustment assembly which can be used to maintain a constant tight seal after repeated use. Also facilitates uniform turning ease. High pressure valves utilize threadless stem that results in reduction of the high operating torque of conventional high pressure valves. (Rockwell Manufacturing Co. Supplements data on pages 4733-4776, 1960-61 Composite Catalog).

For more data, circle E6 on postcard

STUCK PIPE

NO PROBLEM with HILL JAR in STRING



No pipe has ever been lost due to sticking when a J. Ed Hill Jar was in the string above point of sticking.

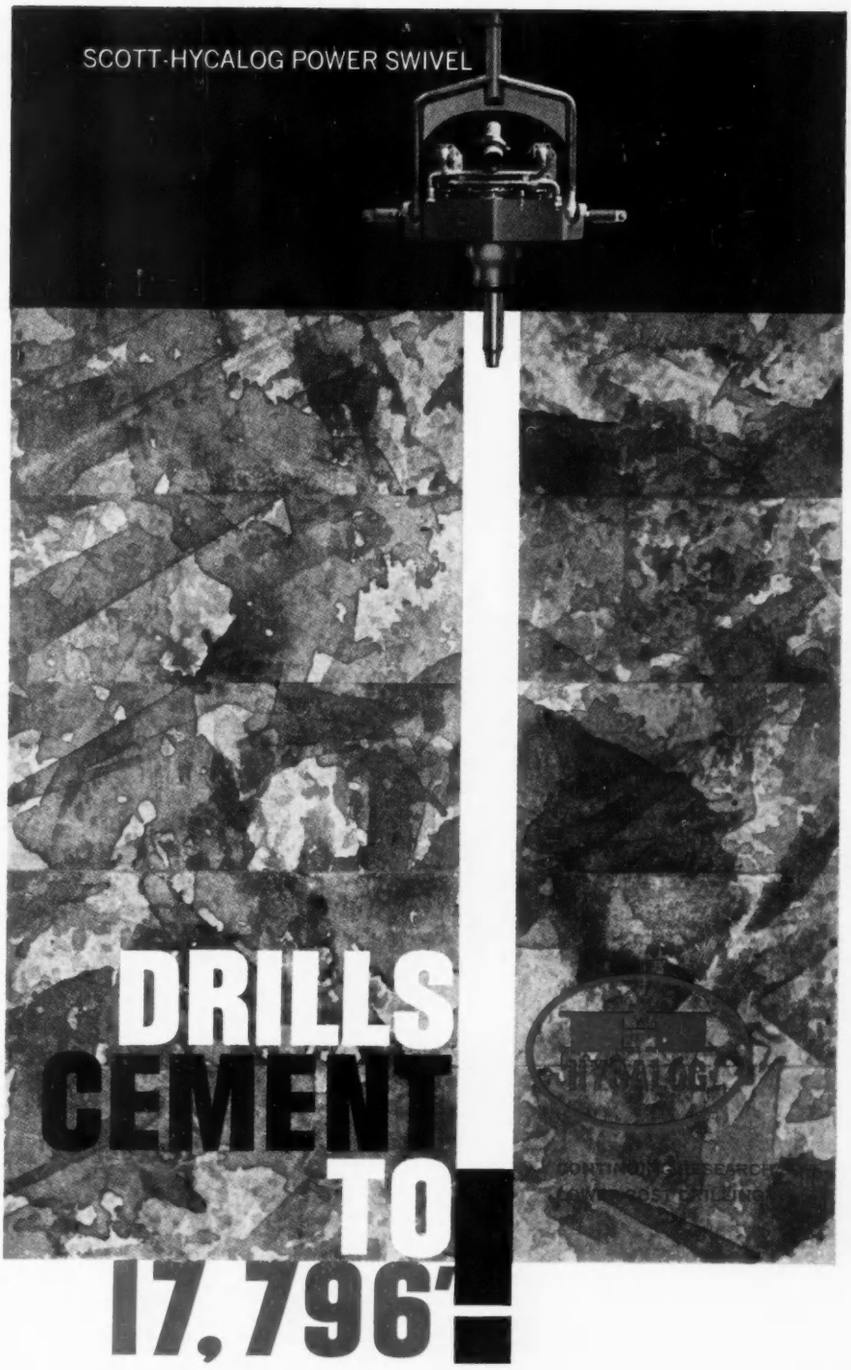
Hill Suspension and Drilling Jars have proved themselves in the deepest wells drilled on the Gulf Coast. One tool has been run in a string for 63 days—packing still in excellent condition. Hill Jars have operated at speeds over 300 rpm with 175,000 lbs. on bit and 3,000 psi constant mud pump pressure.

It is recommended that Hill Jars be placed near the middle of the drill collar string. Jars are available in most popular sizes with connections to fit your string.

Available for rental in U. S. — Sold for export.

SEE OUR CATALOG IN COMPOSITE CATALOG OR SEND FOR A COPY

J. ED HILL, INC.
"DRILLWELL" OIL TOOLS
Main Office: 1003 First City National Bank Building
Phone CApitol 5-1407, Houston 2, Texas
Branches: Route 1, Box 251C, Lafayette, La.
Phone CEnter 4-5635



DRILLS CEMENT TO 17,796'!

NO KELLY OR ROTARY was needed for drilling cement and milling in this Washita County, Oklahoma well. Beginning at 14,300' in 3½" casing a center cut mill on 2" drill pipe was rotated with the power swivel at operating torque of 9920 in. lbs., hook load of 85,000 lbs. and circulating pressure up to 5000 lbs. Drilling rate was controlled to 10 ft. per hr., due to reduced circulation rate. ■ Ask your Hycalog rep how a Scott-Hycalog swivel can save money on your next drilling or workover program.

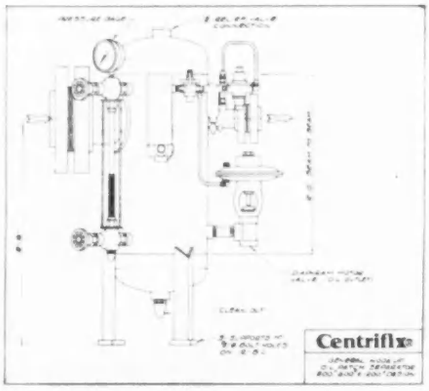
HYCALOG, INC.
505 AERO DRIVE, SHREVEPORT, LOUISIANA
Branch offices in principal oil producing areas
DIAMOND BITS CORE BARRELS WELL LOGGING CORE ANALYSIS

New equipment

Centrifugal Separator

Centrifugal oil-gas separator available in 300, 600 and 1200 psi designs. Units work equally well on high or low gas-oil ratio well streams. Vessels are compact, highly efficient and do not depend on retention time for seperation. (Centrifix Corp.)

For more data, circle E7 on postcard



Today's complex lease operating systems require "stop watch" timing to insure peak efficiency. That's why production men whose job it is to maintain this efficiency insist on ENARDO timing equipment. They know they can rely on ENARDO clocks to keep their lease operations on schedule. They also know that, when repairs are needed, ENARDO'S 24 hour clock repair service will have them ticking again with a minimum of down time.

If you have an ENARDO clock in need of repair, just tell us whether you prefer our "Exchange" or "Repair and Return" service. When you specify "Exchange", send only the clock and case assembly and we will send you an ENARDO rebuilt clock and case assembly from our stock. Should you prefer "Repair and Return", send the complete assembly and we will install a rebuilt clock works. No matter which you prefer, all service will be performed and the units reshipped WITHIN 24 HOURS OF THEIR RECEIPT BY ENARDO!

All rebuilt clocks are thoroughly tested before shipping and each carries ENARDO'S standard 90 day warranty. Remember, keep your lease on time all the time with ENARDO clocks and 24 hour repair service.

Call, write or wire Enardo Manufacturing Co. for further information.

ENARDO manufacturing co.
BOX 1647 • TULSA, OKLAHOMA

Flowline Flow Sensor

A new non-mechanical solid state electrical unit that reports flow or no flow conditions in pipe lines at flow rates as low as 3 gallons per hour without obstructing flow or fluids by vanes, probes or requiring change of flow direction is now available. Uses AC, DC or battery power with current drain of less than 2 watts. Sensor mounting requires only that face be flush with inner pipe surface and can use either welded boss or tee. Small, one-piece sensor body is explosion-proof. (Flotec Corporation).

For more data, circle E8 on postcard

Rotary Hose

Green Triangle rotary hose has patented four ply, single wire construction for reinforcing, neoprene cover. Hose has longer life, is resistant to corrosive muds, gases and foams; heat; abrasion; and chemical attack. It is suitable for any pressure and volume requirement that can be imposed by drilling equipment in use today and exceeds API requirements for Class C rotary hose. Available in standard sizes of 55-60 foot lengths, 3 and 3½-inch ID. (Continental-Emsco Co. Supplements data on pages 1397-1484, 1960-61 Composite Catalog).

For more data, circle E9 on postcard

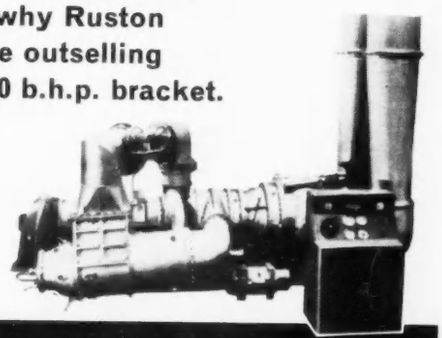
KUWAIT
keep 'em running

'TA' TURBINES AT No. 13 GATHERING CENTER

..."we have received confirmation from Kuwait that a categoric statement could be made that the two (Ruston) turbines of this gathering center have run 21,285 and 21,297 hours respectively without overhaul, and at this present time are still in operation."*

*extract from a letter received from Kuwait Oil Company Limited, Burgan House, London W.1. and published by their permission.

Exceptionally high rates of availability, extending over periods of years between overhauls, is the reason why Ruston industrial gas turbines are outselling all others in the 1000 – 2000 b.h.p. bracket.



RUSTON

GAS TURBINES

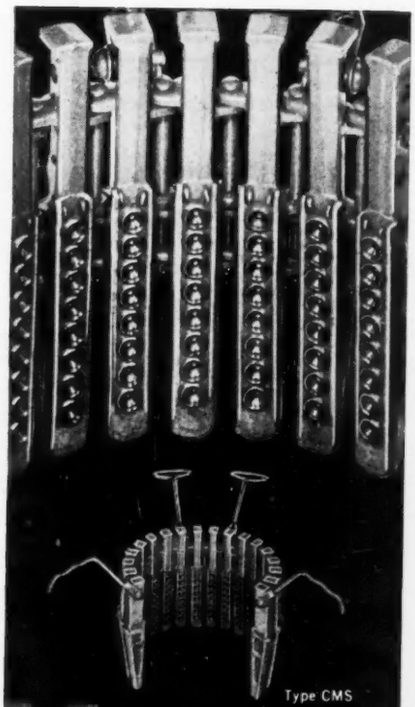
('TA' – 1260 b.h.p., 'TE' – 430 b.h.p.)

Light weight, entirely air-cooled.
Simple push-button starting.
Fuels: natural gas, distillates or selected crudes.

RUSTON & HORNSBY LTD · LINCOLN · ENGLAND Associated with Davey, Paxman & Co., Ltd., Colchester

Representatives in the U.S.A : Beckley, Haltom & Hickman Services Corporation
610 East Palisade Avenue, Englewood, New Jersey

T.4



Type CMS

Varco

CASING SLIPS & BUSHINGS

...make all casing operations faster and simpler. Cementing baskets, scratchers, and centralizers pass through the solid Varco Bushing easily. And because this bushing fits into the main drive square of your rotary table, you can rotate your string at will. Varco Multi-Segment Slips with circular buttons or inserts hold casing safely and securely. Add simplicity and economy to casing programs.

Write for details

Type CU

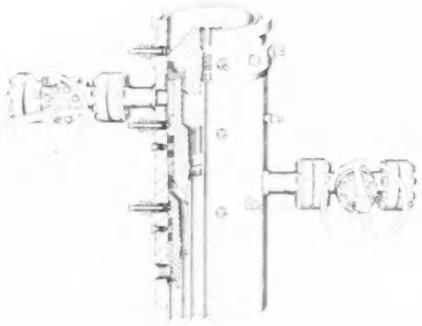
ABEGG & REINHOLD CO.
2533-41 EAST 26TH STREET
LOS ANGELES 54. CALIFORNIA
MIDCONTINENT OFFICE: HOUSTON, TEXAS

New equipment

Automatic Drilling Control

Drillmaster control yields steadier rate of penetration through all types of formations; makes possible drilling of straighter holes; eliminates human error in weight control on the bit; and allows driller more supervisory time. Unit is simple, consisting of four units; sensing, receiver, brake control, and safety governor. (Bowen Itco, Inc. Supplements data on page 713-828, 1960-61 Composite Catalog).

For more data, circle E10 on postcard



Compact Casing Head

Compact head used in place of two or more casing heads and tubing head of a conventional hookup. Illustration shows head made up on surface pipe with intermediate string, oil string and tubing string landed inside. Side outlets connect with each string. Advantages: saves nipple-up time (12-inch preventer need not be removed until Christmas tree is ready to be installed); eliminates flanged joints; total height of wellhead equipment is reduced. (Cameron Iron Works, Inc. Supplements data on pages 1113-1216, 1960-61 Composite Catalog).

For more data, circle E11 on postcard

Sucker Rod

Type S special alloy rod developed for heavy pumping loads in non-corrosive fluids or mildly corrosive fluids which can be effectively inhibited. Chrome-moly sucker rod has tensile strength of 130,000 psi. Available in ⅝-inch, ¾-inch, ⅞-inch and 1-inch sizes with stress relieved pin and rolled threads optional. (Liberty Manufacturing Co. of Texas. Supplements data on pages 3322-3323, 1960-61 Composite Catalog).

For more data, circle E12 on postcard

HERCULES UPSET PUMPING AND FLOWING TEES
Produced from malleable iron with 55,000 psi tensile strength and with an operational rating of 3,000 psi test; 1,500 psi working pressure.

HERCULES CROSS TEES
Made from malleable iron with 55,000 psi tensile strength. These Tees have an operational rating of 4,000 psi test and 2,000 psi working pressure.

HERCULES SPECIAL CROSS TEES
Designed especially to allow adaptation of wider range of thread connections to meet each customer's requirements.

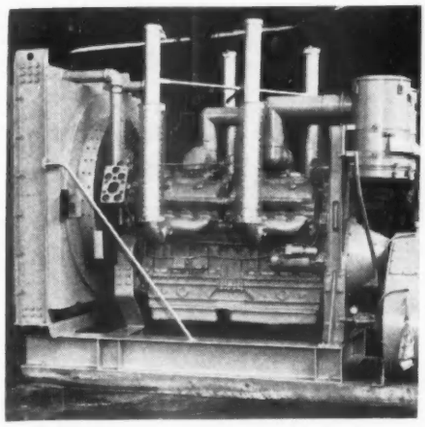
HERCULES TEES

Hercules produces a versatile line of Tees in a wide range of API pipe sizes and threads, in stock for immediate shipment. For general service, Hercules Tees are constructed from malleable iron. For service on wells with corrosion or electrolytic conditions, Hercules Tees are available from other test-proven metals.

HERCULES (DS) DUAL STRING PUMPING TEES
Hercules DS steel pumping Tees were designed primarily for use on dual string pumping wells having minimum center-to-center distances of 3 3⁵⁄₆₄". This Tee may be screwed onto one string of tubing without contacting the other string. Constructed of pressure cast steel and hydrostatically tested to 5,000 psi.

Write for data on pipe sizes and threads of all Hercules Tees

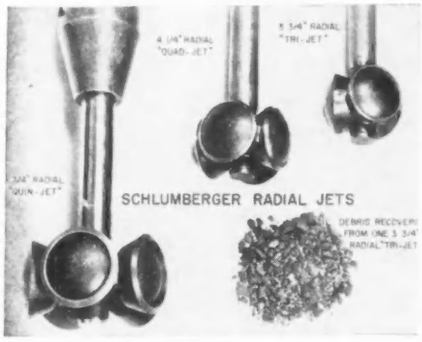
HERCULES TOOL COMPANY
Manufacturers of Oil Field Equipment
GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA
Export Representative Oil Field Equipment Co., Inc. 90 West Street, New York, N. Y.



Compressor Power Unit

Diesel unit with horsepower rating of 430-688 used to power heavy duty portable air compressors used in air drilling operations. Engine is equipped with special radiator cooling system for operation up to 120° ambient temperatures, special dry type air cleaner for top performance in extreme dust conditions. Torque arm drive provides compact reduction ratio between engine and compressor. (Stewart & Stevenson Services, Inc. Supplements data on Pages 5145-5152, 1960-61 Composite Catalog).

For more data, circle E13 on postcard



Multi-Jet Perforator

Expendable, radial-firing, multi-jet gun is designed for use where large diameter holes in single plane are required. Specific applications include perforating prior to fracturing and perforating for thin zone completions, squeeze cementing and sand consolidation. Test firings have consistently produced entrance holes larger than 3¾-inches diameter, penetrations of 3½-inches in standard Berea targets with no casing damage. Available for 4½, 5½, 7-inch casing. (Schlumberger Well Surveying Corp. Supplements data on Pages 4849-4868, 1960-61 Composite Catalog).

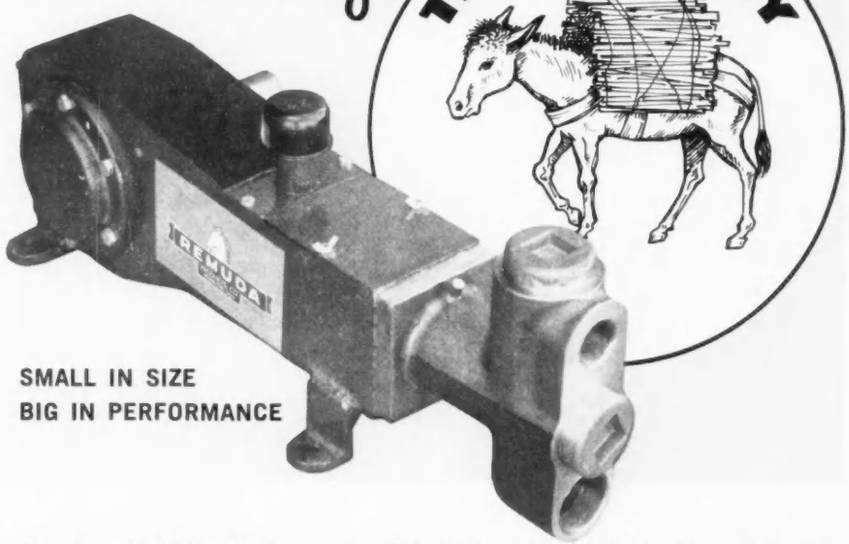
For more data, circle E14 on postcard

Pump Jack

Series "E" jacks feature nodular iron gears, split hub type cranks with full floor clearance. Stroke adjustment obtained by varying position of upper pitman bearing on walking beam and counterbalancing is accomplished by use of counterweights installed on walking beam. Available in unit sizes Nos. 1, 2, 4, 5, 6, 7 and 8. (Jensen Bros. Mfg. Co. Inc. Supplements data on pages 3001-3004, 1960-1961, Composite Catalog).

For more data, circle E15 on postcard

Introducing THE DONKEY



SMALL IN SIZE
BIG IN PERFORMANCE

The Remuda KD-1250 Donkey is a small but extremely rugged 2" x 2½" Horizontal Simplex Pump designed for high pressure requirements such as those encountered in water disposal and oil pipeline gathering systems.

If you're tired of buying more pump than you need in order to get the pressure and volume you need, just note these figures:

Maximum capacity — **408 BPD** at 870 psi with 2" plunger.
Maximum pressure — 102 BPD at **3500 psi** with 1" plunger.
Net weight — **161 pounds.**

Besides its compactness and stamina, the Donkey is completely versatile. Five plunger sizes are available from 1" through 2" to insure the correct size for your requirement. Standard plungers are of 316 stainless steel alloy plus an optional colmonoy plunger and the fluid end of the pump is offered in aluminum-bronze (standard) or 316 stainless steel.

The Donkey has been thoroughly proven in the field and has shown itself to be tough enough to withstand any abuse which might be encountered in all services for which it is intended.

For a detailed description of the Donkey and other quality Remuda Pumps, write

"MORE PUMP PER POUND"

REMUDA PRODUCTS CO.

P. O. BOX 715 • WICHITA FALLS, TEXAS • PHONE 322-4212

If it's important to oil men . . .

In the biennial, three-volume COMPOSITE CATALOG, you have at your fingertips a compact, eight-inch reference shelf and industry buying guide which is unmatched for utility, scope and convenience.

Well over 500 companies selling oil field goods and services file their complete or condensed catalog information in the easy-to-read, convenient COMPOSITE CATALOG.

. . . . it's in Composite Catalog!

To save time *and* money, reach for *your* copy of COMPOSITE CATALOG the next time you buy, specify or compare oil field equipment or services.

COMPOSITE CATALOG

Published by WORLD OIL

GULF PUBLISHING COMPANY • BOX 2608 • HOUSTON 1, TEXAS • JA 9-4301

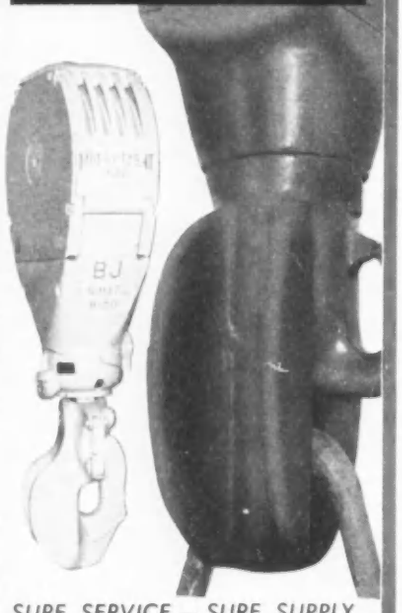
World's Largest Specialized Publisher to the Oil Industries

CALL

MID-CONTINENT

FOR

BLOCK-HOOK ASSEMBLIES



SURE SERVICE — SURE SUPPLY

MC3-1

MID-CONTINENT SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Mid-Continent Building, Fort Worth, Texas
Export Division: 45 Rockefeller Plaza, New York 20, N.Y. Cable: MIDCUMPORT NYK

New literature

To get your copies, circle key numbers on postcard and mail to WORLD OIL

High-Pressure Mud Pumps

Literature is available from Alfred Wirth & Company giving detailed information, diagramatic cross-sectional illustrations and technical data on six recent developments in this manufacturer's line of mud pumps. These include a water-cooled cylinder liner, a new shrink fastening principle for rapid disconnection and attachment of cross-head rods and piston rods, a hydraulic valve cap ceiling system, new erosion-proof valve seating, time-saving screw-in cylinder caps and a hydraulic system for changing pistons.

To get a copy, circle E16 on postcard

Integral Tubing Joint

Folder includes data on 2-inch OD integral joint developed for macaroni tubing. Atlas Bradford Company product now available in J-55, range 2, seamless with API round thread form. Joint is interchangeable with present 1½-inch API EUE and 2 1/16-inch integral joints.

To get a copy, circle E17 on postcard

Packaged Compressor

Bulletin describes C-B/Southern Model AM-2, AM-4 packaged field gas gathering compressors. Includes dimensions, operating data, features. 4 pages.

To get a copy, circle E18 on postcard

Multiple Completions

W-K-M Oil and Gas Well Multiple Completion Data Handbook contains detailed engineering information on tubing, casing and valves used in multiple completion programs. Book reduces computations required in programing multiple well completions, provides general information unobtainable except from many separate sources.

To get a copy, circle E19 on postcard

Spiral Drill Collars

McClinton Tool Company folder (4 pages) describes new spirally grooved drill collar designed to eliminate differential sticking problems. Discusses advantages, operation, and contains prices.

To get a copy, circle E20 on postcard

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

J. C. Kinley Co. Licensees

ABILENE, TEX.—Eads Eng. Serv., Inc...OR 2-8685
ANDREWS, TEXAS
John Kuykendall Wireline Service Co...LA 3-4303
BAKERSFIELD, CALIF.—Archer-Reed...FA 5-4203
BAY CITY, TEX.—J. P. Graham.....GI 5-4526
BEAUMONT, TEX.—Camco....TE 2-5443, TE 8-4851
BURAS, LA.—Camco, Inc.....OL 7-9492, OL 7-9974
CASPER, WYOMING—Camco, Inc.....23 7-3885
C. A. White.....23 3-5264
CORPUS CHRISTI, TEX.
Camco, Inc.....TU 3-9371, TU 4-4462
Tolle, Inc.....TE 5-5367
FARMINGTON, N. M.—B & R, Inc.....DA 5-2393
Camco, Inc.....DA 5-7134
FULLERTON, CALIFORNIA—Dyna-Log..LA 6-1184
GLENDIVE, MONTANA—C. A. White..EM 5-3833
HOBBS, N. M.—Horne Serv. Co.....EX 3-5596
HOUMA, LA.—Camco, Inc....UP 3-7330, UP 2-3804
Klein Deco Wire Line.....UP 2-4537
HOUSTON—Long Line Prod. Control.....GR 3-5739
Mid-Western Well Serv. Co.....RE 4-4337
BHP Engineering & Equipment Co., Inc..MI 5-2555
KERMIT, TEX.—Kuykendall Wireline....JU 6-4538
Mid-Western Well Serv. Co.....RE 4-4262
LAFAYETTE, LA.—Camco....CE 5-3124, CE 5-6687
LIBERAL, KAN.—Rainbo Serv. Co.....MA 4-3588
MIDLAND, TEXAS—Lucous Serv.....MU 2-8311
NEW IBERIA, LA.—Cardinal Wireline...EM 4-5166
Klein Deco-Wire Line.....EM 4-0471
ODESSA, TEXAS—Kuykendall Wireline..FE 7-7210
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co.....ME 4-2131, ME 4-0105
PETTUS, TEXAS
Eddie Jones Eng. Co. Pettus 16-Beeville FL 8-1218
VICTORIA, TEXAS—Camco, Inc.....HI 3-9251
WICHITA FALLS, TEXAS
Eads Eng. Serv., Inc.....776-8831
WILLISTON, N. D.—C. A. White.....GR 3-6555
EDMONTON, ALBERTA, CANADA
Camco, Ltd.....GE 9-3641, GE 9-3124
VENEZUELA:
Anamio Anzoategui—A-Z Export, S.A.
Maracaibo—A-Z Export, S.A.....6982-3480
Puerto La Cruz—A-Z Export, S.A.....88-332
Anzoategui W. L. Service 24-353

New PC-5

Non-Flammable
ALL-PURPOSE
Rig Cleaner

IS DISTRIBUTED IN THE GULF COAST AREA BY

WILSON SUPPLY CO

MAIN OFFICE AND WAREHOUSE
1301 CONTI • HOUSTON 6117

Power Slush Pumps

Continental-Emsco bulletin (12 pages) contains performance data charts, specifications and dimensions for all seven pumps manufactured by the company. Cutaway views of power and fluid ends included.

To get a copy, circle E21 on postcard

Perforating

Lane-Wells brochure on NCF II shaped charge for retrievable casing perforators explains how new development has extended penetration, improved well flow indices, enlarged shot hole diameter. The charge is used in Koneshot perforators in standard sizes down to 4½-inch.

To get a copy, circle E22 on postcard

Ignition Conversion Kit

Stewart and Stevenson Services Inc. folder (4 pages) describes spark ignition kit for converting Series 71 General Motors diesel engines to natural gas operation. Converted engines develop full rated horsepower, have excellent acceleration and lugging characteristics.

To get a copy, circle E23 on postcard

Slim Hole Pumps

Continental-Emsco bulletin describes slim hole subsurface pumps for 1¼-, 1½- and 1¾-inch nominal ID tubing. Standard pump assemblies, stroke length data, seating shoe, nipple and ring specifications, and pump and tubular specifications are included.

To get a copy, circle E24 on postcard

Computer Fracturing Service

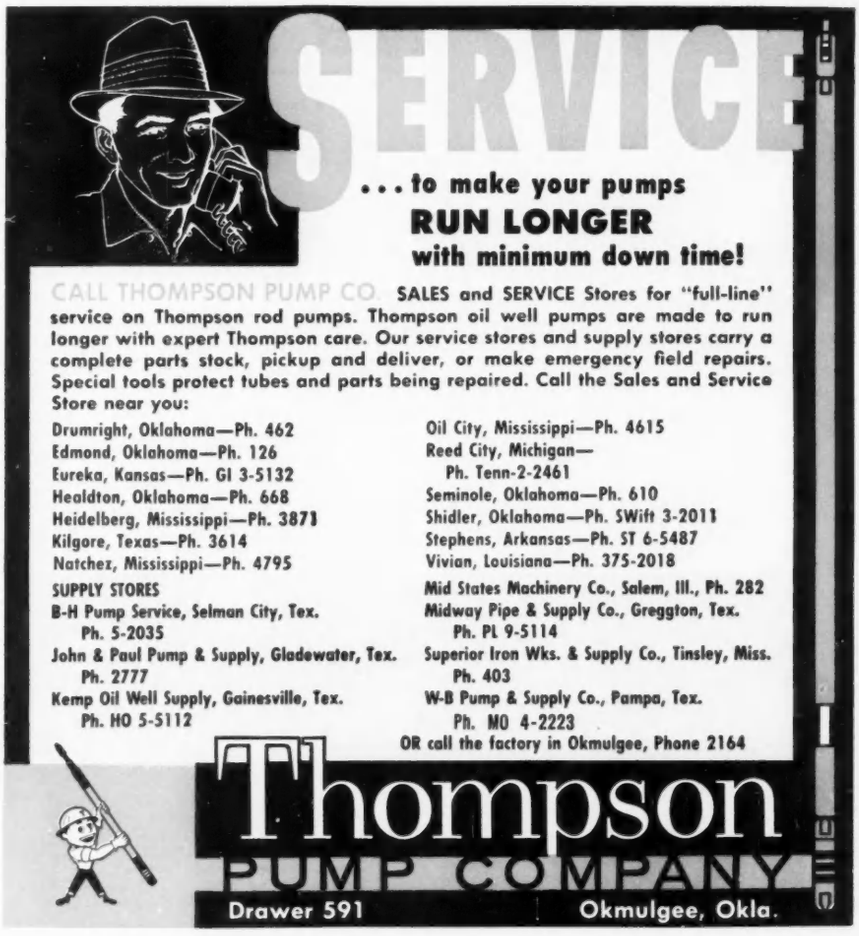
BJ Service, Inc. "Compufrac" service is described in detail. Service utilizes an IBM 1620 data processing system to solve for fracture areas at various volumes and injection rates for any number of fracturing fluids. All outputs are based on calculated fracture widths for more accurate fluid comparisons. Compufrac solves for either horizontal or vertical fractures.

To get a copy, circle E25 on postcard

Hammerdrill

Brochure (6 pages) describes Mission Mfg. Co.'s Series 350 Hammerdrill for air and gas drilling. Included are case history data on 20 drilling jobs in the United States and Canada and specifications on various sizes of tools.

To get a copy, circle E26 on postcard


SERVICE
. . . to make your pumps
RUN LONGER
with minimum down time!
CALL THOMPSON PUMP CO.
SALES and SERVICE Stores for "full-line" service on Thompson rod pumps. Thompson oil well pumps are made to run longer with expert Thompson care. Our service stores and supply stores carry a complete parts stock, pickup and deliver, or make emergency field repairs. Special tools protect tubes and parts being repaired. Call the Sales and Service Store near you:
Drumright, Oklahoma—Ph. 462
Edmond, Oklahoma—Ph. 126
Eureka, Kansas—Ph. GI 3-5132
Healdton, Oklahoma—Ph. 668
Heidelberg, Mississippi—Ph. 3871
Kilgore, Texas—Ph. 3614
Natchez, Mississippi—Ph. 4795
Oil City, Mississippi—Ph. 4615
Reed City, Michigan—Ph. Tenn-2-2461
Seminole, Oklahoma—Ph. 610
Shidler, Oklahoma—Ph. SWift 3-2011
Stephens, Arkansas—Ph. ST 6-5487
Vivian, Louisiana—Ph. 375-2018
SUPPLY STORES
B-H Pump Service, Selman City, Tex. Ph. 5-2035
John & Paul Pump & Supply, Gladewater, Tex. Ph. 2777
Kemp Oil Well Supply, Gainesville, Tex. Ph. HO 5-5112
Mid States Machinery Co., Salem, Ill., Ph. 282
Midway Pipe & Supply Co., Greggton, Tex. Ph. PL 9-5114
Superior Iron Wks. & Supply Co., Tinsley, Miss. Ph. 403
W-B Pump & Supply Co., Pampa, Tex. Ph. MO 4-2223
OR call the factory in Okmulgee, Phone 2164
Thompson
PUMP COMPANY
Drawer 591
Okmulgee, Okla.

MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

Write for our new catalog or see it in the Composite (24th Edition). All products sold thru supply companies.

JOHN N. MARTIN
Manufacturer
9 W. BRADY STREET • TULSA, OKLAHOMA

Advertisers in this issue

• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 24th (1960-61) Revision of The Composite Catalog of Oil Field Equipment.

A

• ACF Industries, Inc.
W-K-M Division 153
• Abegg & Reinhold Co. 163b
Red Adair Chemical 140
Air France 136a
• Allis-Chalmers 40
Anchor Coupling Co. 129
• Armco Steel Corp. ..... 35-36-37-38, 52, 66 and 150-151
• Atlas Bradford Co. 79
Autocar Division
The White Motor Co. 62

B

• Baash-Ross Division
Joy Manufacturing Co. 39
• Baker Oil Tools, Inc. ..... 21, 23 and 25
Bank of the Southwest 77
Barksdale Valves 131c
The Bendix Corp.
Bendix International Division 80
• Bethlehem Steel Co. 67
• Borg-Warner Corp. ..... 74 and 127
• BJ Service, Inc. 74
The Bovaird Supply Co. 49
British Overseas Airways Corp. 60a
• Brown Oil Tools, Inc. 68

C

• Camco, Inc. 41
• Capitol Manufacturing Co.
Division Harsco Corp. 138
• Chicago Pneumatic 134-135
• Chiksan Co. 65
Classified 152
• The Colorado Fuel & Iron Corp. ..... 50 and 82
Columbia-Geneva Steel Division
United States Steel 29
Compagnie Generale de Geophysique 72
• Composite Catalog 166-167
• Continental-Emsco Co.
A Division of The Youngstown
Sheet & Tube Co. 132-133
• Crall Products, Inc. 152a

D

Delta Air Lines 142
• Demag Aktiengesellschaft 7
• Dover Corp. 61
Dowell ..... 10 and 174
• Dresser Industries, Inc. 18-19
Drilling Specialties Co. 87
E. I. du Pont de Nemours & Co. 53

E

• Enardo Manufacturing Co. 162

F

• Failing Supply Ltd. England 59
• Fluid Packed Pump
Armco Steel Corp. 66
Ford Motor Co. 32-33

G

G & H Offshore Towing Co. 73
Geolograph Oil Field Services 124
Geophysical Service, Inc. 27
• Globe Oil Tools Co. 54
• Grant Oil Tool Co. 83
• Gray Tool Co. 128c
Great Lakes Carbon Corp. 146
• Grove Valve & Regulator Co. 46-47
Gulf Publishing Co. 128d

H

• Halliburton Co. ..... 2, 88 and 154-155
• Hands-England Oilfield Equipment Ltd. 130b
• Harsco Corp. 138
• Hercules Tool Co. 164
• J. Ed Hill, Inc. 161a
• Hycalog, Inc. 161b

I

• Imperial Ethiopian Government 123

J

• Jet-Lube, Inc. 169b
• Joy Manufacturing Co. 39

K

• J. C. Kinley Co. ..... 130a and 168b

L

• Lane-Wells Co. 173
• Link-Belt Co. 30-31
• Lone Star Steel Co. 125
• Lufkin Foundry & Machine Co. 42
• Lynes, Inc. 76

M

Mack Trucks, Inc. 78
• Magnet Cove Barium Corp. 147
• John N. Martin Manufacturer 170
• Martin-Decker Corp. ..... 6a and 128b
• McCullough Tool Co. 149
• McKissick Products Corp. 51
• Mid-Continent Supply Co. ..... 126, 148 and 168a
Midwest Oil Register, Inc. 136b
• Milwhite Mud Sales Co. 16
• Mission Manufacturing Co. 84

N

The National Bank of Commerce 58
National Bank of Tulsa 6b
• National Supply Division
Armco Steel Corp. 35-36-37-38
National Tube Division
United States Steel 29
Nitrogen Oil Well Service Co. 137
• W. C. Norris Division
Dover Corp. ..... 61 and 144

O

• Oil Center Tool Co. 57
• Oil Metering & Processing Equipment Corp. 139
• Oil Well Supply Division
United States Steel 158-159

P

• Parkersburg
Division of Parkersburg-Aetna Corp. 143
• Pont-A-Mousson 69-70-71
• Pontex Pipe Corp. 69-70-71
• Porta-Kamp Manufacturing Co. 132b
• Pressure Services, Inc. 131a

R

Rectorseal 128a
• Regan Forge & Engineering Co. 160
Remuda Products Co. 165
• Rockford Clutch Division
Borg-Warner Corp. 127
• Rockwell Manufacturing Co. 121
John A. Roebling's Sons Division
The Colorado Fuel & Iron Corp. 50
The Royal Bank of Canada 56
• Ruston & Hornsby Ltd. 163a

S

• Salzgitter Maschinen A. G. 157
• Schlumberger Well Surveying Corp. 55
• Security Engineering Division
Dresser Industries, Inc. 18-19
• Servco Co. 86
• Shaffer Tool Works 75
Sheffield Division
Armco Steel Corp. 52
Siegener AG 60b
• Smith Tool Co. 45
Square D Co. 85
Stephens Engineering 152b
• Swaco 34

T

• Technical Oil Tool Corp. 63
• Thompson Pump Co. 169a
• Thornhill-Craver Co. 145
• Tretolite Co.
Division Petrolite Corp. 8
• Tube-Kote, Inc. 64
• Tuboscope Co. 141

U

• Union Wire Rope
Armco Steel Corp. 150-151
United States Steel Corp. ..... 29, 43 and 158-159
United States Steel Export Co. 29
• Universal Atlas Cement Division
United States Steel 43

W

• W-K-M Division
ACF Industries, Inc. 153
• Waukesha Motor Co. 12
The White Motor Co. 62
• Wilson Supply Co. ..... 81 and 168c
• World Oil 119

Y

• The Youngstown Sheet & Tube Co. 132-133

use these

READERS' SERVICE CARDS

for more information

Here is a quick, convenient way

to get more information on New Equipment reviewed in the editorial columns and on products and services advertised in this issue of WORLD OIL:

1. For more data on New Equipment reviewed in the editorial columns, circle on the card below the Code Number shown in the item itself.
2. For more data on Advertised Products and Services, circle on card the actual page number of the advertisement as listed in the Advertisers' Index on the preceding page.
3. Then, print your name, title, company and complete mailing address and drop the card in the mail. WORLD OIL's Readers' Service Department will promptly forward your requests to the company concerned. The requested information will then be mailed directly to you.

Note: WORLD OIL will request the companies to forward the information to you by mail.

Postage Will be Paid by Gulf Publishing Company

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 7, Houston, Texas

WORLD OIL Readers' Service Dept.
GULF PUBLISHING COMPANY
BOX 2608
HOUSTON 1, TEXAS, U. S. A.

Circle code number for more data on "New Equipment" editorial items

Circle page number for more information on ADVERTISED products

WORLD OIL Readers' Service Card — December 1961 Issue*

EDITORIAL ITEMS—Circle code numbers on which more information desired

E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13
E14	E15	E16	E17	E18	E19	E20	E21	E22	E23	E24	E25	E26

ADVERTISEMENTS—Circle page number of ad for more product information.

2	6	6a	6b	7	8	10	12	16	18—19	21	23	25	27	29	30—31	32—33			
34	35—36	37—38	39	40	41	42	43	45	46—47	49	50	51	52	53	54	55			
56	57	58	59	60	60a	60b	61	62	63	64	65	66	67	68	69—70—71	72	73		
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	121	123	124	125	126
127	128	128a	128b	128c	128d	129	130	130a	130b	131	131a	131b	131c	132—133	134—135	136	136a		
136b	137	138	139	140	141	142	143	144	145	146	147	148	149	150—151	152	152a	152b	153	
154—155	157	158—159	160	161	161a	161b	162	163	163a	163b	164	165	166—167	168	168a	168b			
168c	169	169a	169b	170	173	174													

Name (Please Print)_____

Company_____ Position_____

Address_____

MAIL IT NOW... DECEMBER ISSUE CARD EXPIRES FEB. 28, 1962 Check Square for Extra Card ☐

use these

READERS' SERVICE CARDS

for more information

Here is a quick, convenient way

to get more information on New Equipment reviewed in the editorial columns and on products and services advertised in this issue of WORLD OIL:

1. For more data on New Equipment reviewed in the editorial columns, circle on the card below the Code Number shown in the item itself.
2. For more data on Advertised Products and Services, circle on card the actual page number of the advertisement as listed in the Advertisers' Index on the preceding page.
3. Then, print your name, title, company and complete mailing address and drop the card in the mail. WORLD OIL's Readers' Service Department will promptly forward your requests to the company concerned. The requested information will then be mailed directly to you.

WORLD OIL Readers' Service Card — **December 1961 Issue***

EDITORIAL ITEMS—Circle code numbers on which more information desired

E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13
E14	E15	E16	E17	E18	E19	E20	E21	E22	E23	E24	E25	E26

ADVERTISEMENTS—Circle page number of ad for more product information.

2	6	6a	6b	7	8	10	12	16	18—19	21	23	25	27	29	30—31	32—33		
34	35—36		37—38		39	40	41	42	43	45	46—47		49	50	51	52	53	54	55
56	57	58	59	60	60a	60b	61	62	63	64	65	66	67	68	69—70		71	72	73
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	121	123	124	125	126
127	128	128a	128b	128c	128d	129	130	130a	130b	131	131a	131b	131c	132—133		134—135		136	136a
136b	137	138	139	140	141	142	143	144	145	146	147	148	149	150—151		152	152a	152b	153
154—155		157	158—159		160	161	161a	161b	162	163	163a	163b	164	165	166—167		168	168a	168b
168c	169	169a	169b	170	173	174													

Name (Please Print)_____

Company_____ Position_____

Address_____

MAIL IT NOW... DECEMBER ISSUE CARD EXPIRES FEB. 28, 1962 Check Square for Extra Card ☐

Circle code number for more data on "New Equipment" editorial items

Circle page number for more information on ADVERTISED products

Postage Will be Paid by Gulf Publishing Company

No Postage Stamp Necessary if Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 7, Houston, Texas

WORLD OIL Readers' Service Dept.

GULF PUBLISHING COMPANY

BOX 2608

HOUSTON 1, TEXAS, U. S. A.

Note: WORLD OIL will request the companies to forward the information to you by mail.

This Information Business Never Stands Still!

Providing a full range of well logging and other wire line services any time, anywhere, is only one part of Lane-Wells' service to its customers.

Keeping always abreast of industry trends, and developing new tools and new applications to meet these trends, is the other vital part of the company's activities. To accomplish this, Lane-Wells maintains a continuous three-part program:

directed toward extending basic information leading to more accurate formation evaluation and successful well completion. Geared to the changing trends of the industry, this research is objectively applied to the practical design of new tools and methods.

versatile enough for prompt application of research solutions to the development of rugged, field-worthy equipment designed for reliable operation under adverse conditions.

that provides personnel trained to apply the results of research and development, bringing to the well the most modern equipment for the job and the skill to use it to best advantage.

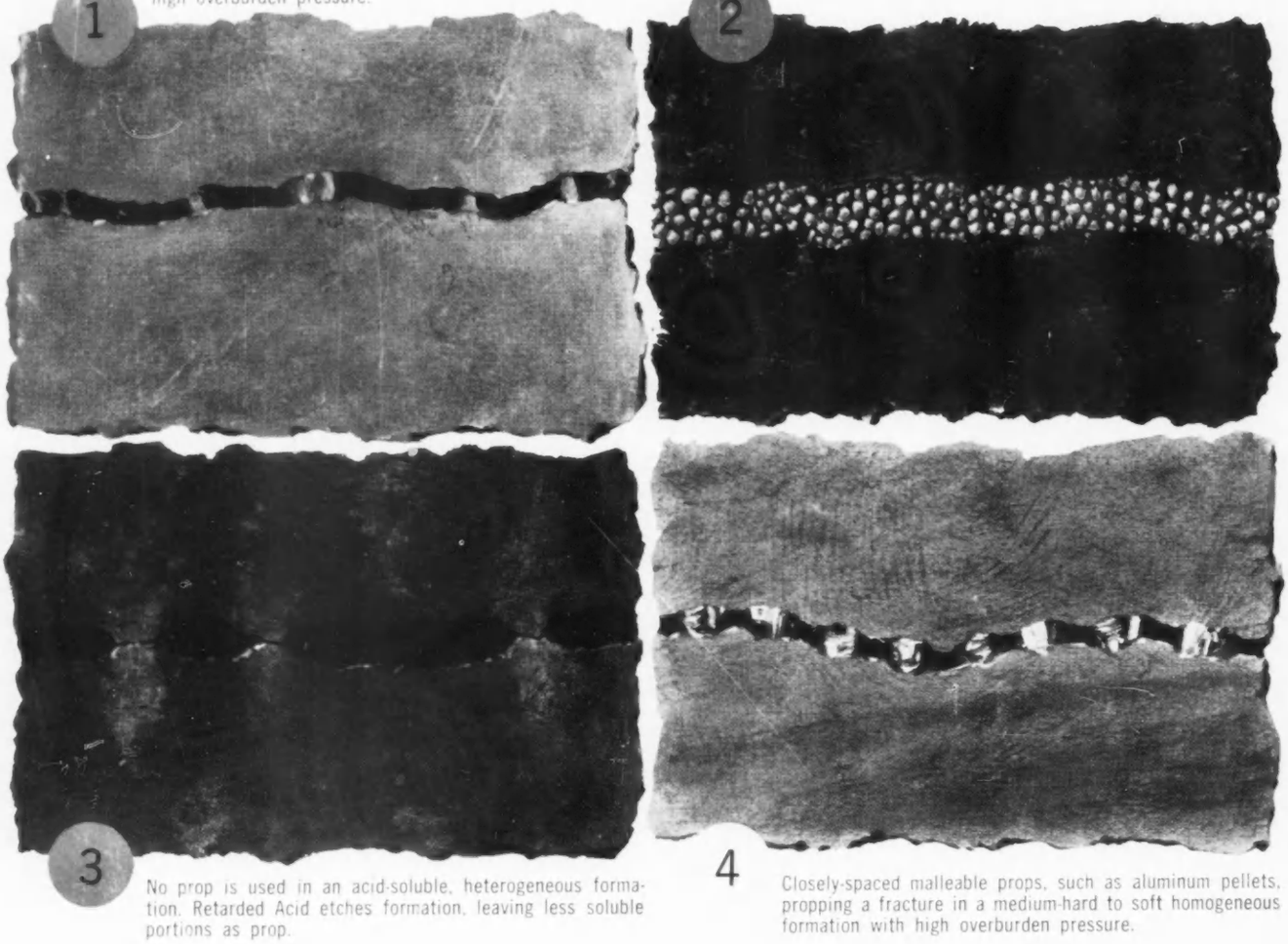
You can rely on this combination of Lane-Wells' *research, development* and *service* to give you the best buy in logging and completion services.

LANE-WELLS COMPANY

A Division of Dresser Industries, Inc.

P. O. BOX 1407 • HOUSTON 1, TEXAS

Lane-Wells' consolidated general offices, research, development and manufacturing facilities—Houston.



1 Widely-spaced malleable props, such as rounded walnut shells, propping a fracture in a hard homogeneous formation with high overburden pressure.

2 Sand fully packed into a fracture in a homogeneous formation with low permeability and moderate overburden pressure.

3 No prop is used in an acid-soluble, heterogeneous formation. Retarded Acid etches formation, leaving less soluble portions as prop.

4 Closely-spaced malleable props, such as aluminum pellets, propping a fracture in a medium-hard to soft homogeneous formation with high overburden pressure.

fracture conductivity tests help operators select most profitable stimulation treatments

For more than a year, Dowell laboratories have been measuring and compiling data on flow capacities of fractures in various formations. The effects of different fracturing fluids and propping agents on fracture conductivity are compared. The illustrations here show four examples of fracture props that are frequently checked.

Flow capacity data from these tests — plus other pertinent well information — are interpreted through the Frac Guide* by Dowell engineers to help design the most profitable fracturing treatments for you.

In many cases, operators have realized much faster payouts than had been recognized as normal for a field. In some instances, Dowell has helped operators avoid many unprofitable jobs. In most cases, average profits have been increased over previously accepted norms.

In designing a stimulation treatment, it is best to test actual cores from your well. However, if cores are not available, cuttings can often be used. These cuttings are compared for similarity with the numerous cores already tested and cataloged by Dowell.

Ask your Dowell representative for a free copy of the new "Technical Report on Fracture Conductivity." It deals with such factors as size, type and amount of propping agent, hardness of formation and overburden pressure.

The fracture conductivity testing program is another important step in Dowell's continuing research and service program to help you make more profits. Dowell services and products are offered in North and South America, Europe and North Africa. Dowell, Tulsa 1, Oklahoma. *DOWELL SERVICE MARK

SERVICES FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

COLLAPSE RATING
(640-11,000 PSI)

COLLAPSE RATING
(2,500-12,500 PSI)

DEPTH
(x 10^3 FT.)

WEIGHT OR LENGTH
(LBS. OR FT.)
(ANY MULTIPLE OF 10)

B

8⁵49P
8⁵49S
8⁵44P
8⁵44S
9⁵53.5S
9⁵53.5P
10⁵65.7P
8⁵40S
8⁵40P
8⁵49N
9⁵47S
10⁵60.7P
8⁵44N
9⁵47P
9⁵53.5N
8⁵36S
9⁵43.5S
8⁵40N
10⁵55.5S
10⁵55.5P
9⁵47N
9⁵43.5P
8⁵36N
13⁵85N
10⁵55.5N
11⁵60S
9⁵43.5N
16-118N
9⁵40S
10⁵51P
10⁵51N
11⁵60N
13⁵77N
9⁵40N
13⁵72S
8⁵36J
10⁵45.5S
11⁵54S
9⁵36S80
13⁵72N
10⁵51J
13⁵68S
11⁵60J
16-109J
9⁵40J
8⁵32J
10⁵45.5J
9⁵36J
11⁵54J
13⁵68J
10⁵40.5S
13⁵61S
11⁵47S
10⁵40.5J
13⁵61J
11⁵47J
8⁵24J
13⁵54.5S
16-84J
13⁵54.5J
16-75J
16-65H

B'

5¹8P
7-35P
7-35S
5½20P
7-39P
7-32P
7-39S
7-32S
5-15P
7-29P
7-29S
7-38N
5½23N
7-33.7S
7-33.7P
4½11.6P
5½17P
5-18N
7-35N
10⁵60.7P
5-15N
7-29N
7¹29.7P
7¹33.7N
4½11.6N
5½17N
7-23S
7-26N
5-15J
7¹29.7N
7¹26.4S
4½11.6J
5½17J
7-23N
7-26J
7¹26.4N
5-13J
5½15.5J
4½9.5J
7-23J
5½14J
5-11.5J
7¹26.4J
7-20J

A

20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0

E

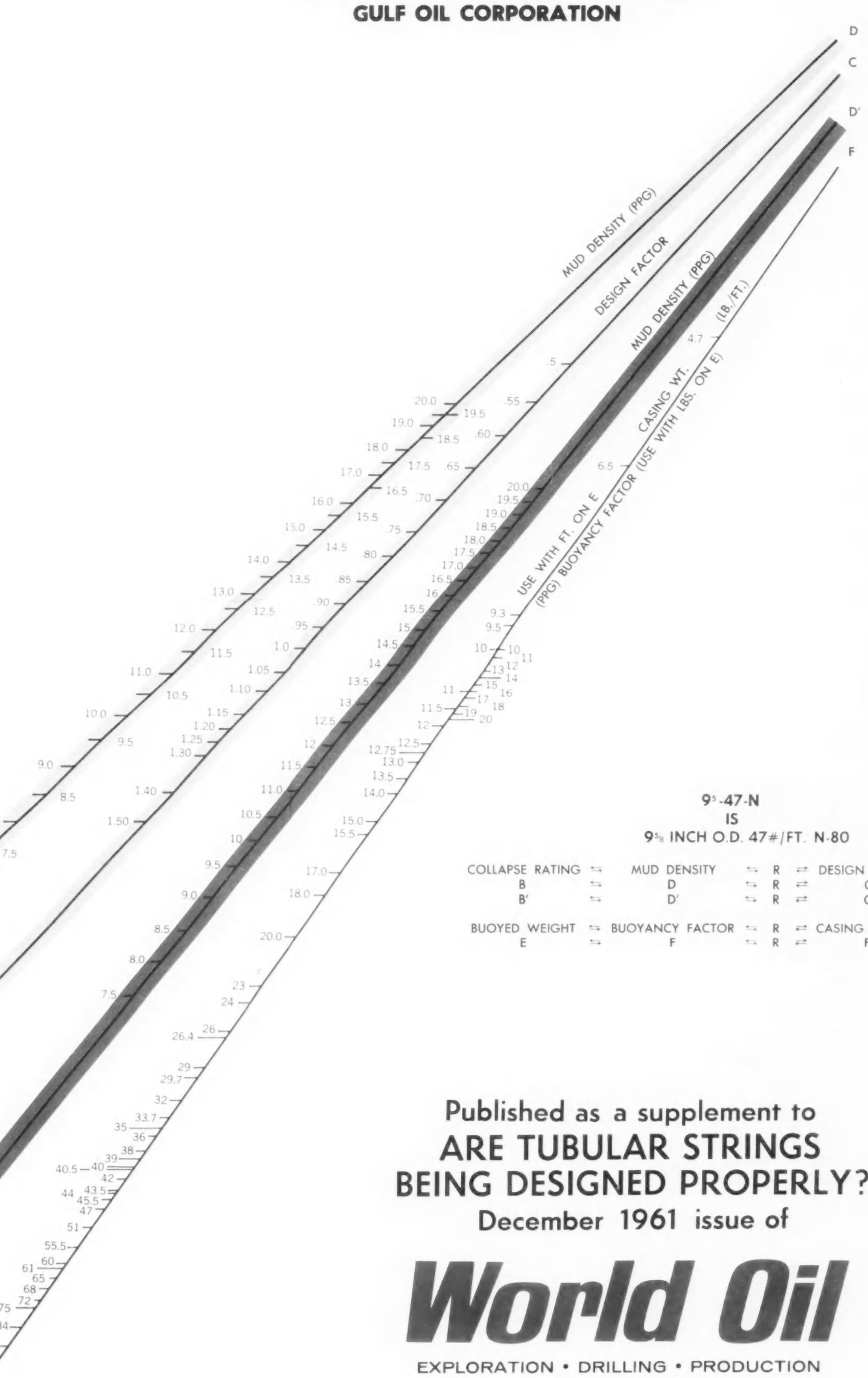
10
9
8
7
6
5
4
3
2
1
0

8.0
7.5
61
65
68
72
75
84
94

CASING DESIGN CHART

(COLLAPSE AND BUOYED WEIGHT)

DRILLING UNIT TECHNICAL SERVICES
DOMESTIC PRODUCTION DEPARTMENT
GULF OIL CORPORATION



9⅝-47-N
IS
9⅝ INCH O.D. 47#/FT. N-80

COLLAPSE RATING	⇆	MUD DENSITY	⇆	R	⇄	DESIGN FACTOR	⇄	DEPTH
B	⇆	D	⇆	R	⇄	C	⇄	A
B′	⇆	D′	⇆	R	⇄	C	⇄	A
BUOYED WEIGHT	⇆	BUOYANCY FACTOR	⇆	R	⇄	CASING WEIGHT	⇄	LENGTH
E	⇆	F	⇆	R	⇄	F	⇄	E

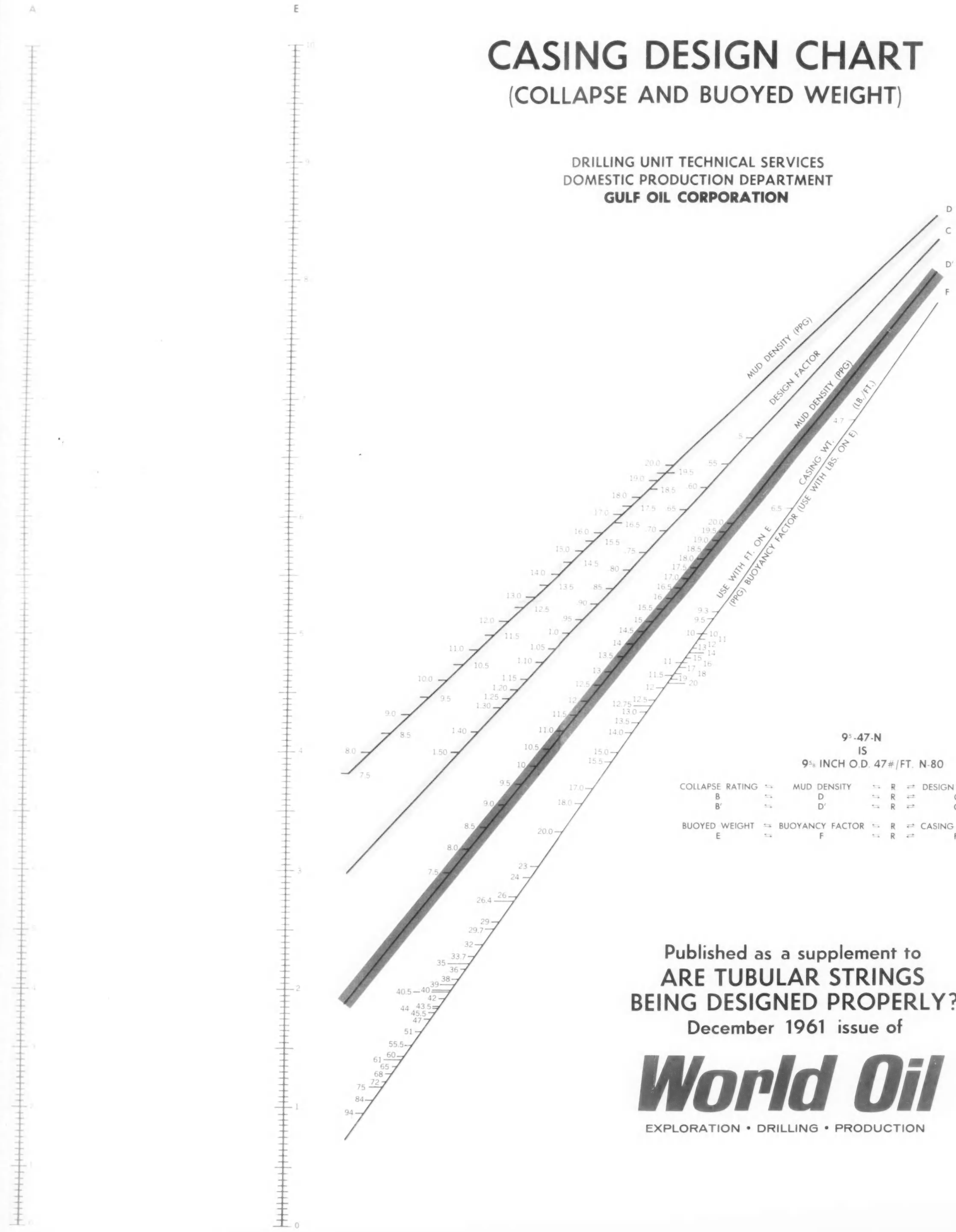
Published as a supplement to
ARE TUBULAR STRINGS
BEING DESIGNED PROPERLY?
December 1961 issue of

World Oil

EXPLORATION • DRILLING • PRODUCTION

CASING DESIGN CHART
(COLLAPSE AND BUOYED WEIGHT)

DRILLING UNIT TECHNICAL SERVICES
DOMESTIC PRODUCTION DEPARTMENT
GULF OIL CORPORATION



9⁵-47-N
IS
9⁵/₈ INCH O.D. 47#/FT. N-80

COLLAPSE RATING		MUD DENSITY		R		DESIGN FACTOR		DEPTH
B	⇆	D	⇆	R	⇄	C	⇄	A
B′	⇆	D′	⇆	R	⇄	C	⇄	A

BUOYED WEIGHT		BUOYANCY FACTOR		R		CASING WEIGHT		LENGTH
E	⇆	F	⇆	R	⇄	F	⇄	E

Published as a supplement to
ARE TUBULAR STRINGS BEING DESIGNED PROPERLY?
December 1961 issue of
World Oil
EXPLORATION • DRILLING • PRODUCTION

UNITS

WT. = LBS./FT.

GRADE = J - 55, N - 80, P - 110, S - 95

TENSION STRENGTH = 1000 LBS.

944 / 539 = JOINT STRENGTH / JOINT STRENGTH / 1.75

DRIFT = INCHES

R

TENSION STRENGTHS ARE BASED ON MINIMUM TENSILE STRENGTH AND THE CRITICAL AREA OF THE JOINT OR PIPE BODY AND THE CRITICAL AREA OF THE JOINT OR PIPE BODY.

			TENSION STRENGTH (1000 POUNDS)							
WT./GRADE		BURST	PIPE BODY	EXLINE	SPEEDTITE	BUTTRESS	TRIPLE SEAL	8 ROUND LT	8 ROUND ST	DRIFT
					4½ INCH CASING					
9.5	J	4380	210						128/73	3.965
11.60	J	5350	250			222/127		189/108	159/91	3.875
	N	7780	338			355/203		220/126		
	P	10690	418			418/240		288/165		
13.50	N	9020	384			384/220		258/147		3.795
	P	12410	480			480/274		337/193		
15.1	P	14420	552			550/314		394/225		3.701
					5 INCH CASING					
11.5	J	4240	247						152/87	4.435
13	J	4870	280			280/60	189/108	210/120	178/102	4.369
15	J	5700	328	328/187		328/187	234/134	247/141	210/120	4.283
	N	8290	437	437/250		437/250	312/178	288/165		
	P	11390	546	546/312		546/312	390/223	377/215		
18	N	10140	527	470/269		527/301	388/222	354/202		4.151
	P	13940	659	587/335		659/377	485/277	463/265		
					5½ INCH CASING					
14	J	4270	306						186/106	4.887
15.50	J	4810	338		321/183	338/193	235/134	244/139	211/121	4.825
17	J	5320	382	382/218	354/202	382/218	269/154	275/157	234/134	4.767
	N	7740	496	490/280	472/270	496/283	358/205	320/183		
	P	10640	620	620/354	591/338	620/354	448/256	418/239		
20	N	9190	582	521/298	496/283	582/332	445/254	382/218		4.653
	P	12640	728	652/373	620/354	728/416	556/318	500/286		
23	N	10560	663	579/331	496/283	663/379	464/265	440/251		4.545
	P	14520	828	723/413	620/354	828/473	569/325	576/329		
					7 INCH CASING					
20	J	3740	430						254/145	6.331
23	J	4360	490		490/280	490/280	335/191	344/197	300/171	6.241
	N	6340	665			665/380		400/229		
	S95	6340							467/267	
26	J	4980	565	504/288	537/307	565/323	422/241	395/226	345/197	6.151
	N	7240	755	673/385	717/410	755/431	562/321	460/263		
	P	9960	943	841/481	869/497	943/539	703/402	602/344		
	S95	7240							556/318	
29	N	8160	845	719/411	740/423	845/483	653/373	520/297		6.059
	P	11220	1056	899/514	925/529	1056/603	816/466	681/389		
	S95	8160							644/368	
32	N	9060	932	804/459	740/423	932/533	730/417	578/330		5.969
	P	12460	1164	1004/574	925/529	1164/665	847/484	756/432		
	S95	9060							729/417	
35	N	9960	1017	893/510	740/423	1017/581	730/417	635/363		5.879
	P	13690	1271	1115/637	925/529	1271/726	874/499	831/475		
	S95	9960							819/468	
38	N	10800	1096	969/554	740/423	1096/626	730/417	688/393		5.795
	P	14850	1369	1209/691	925/529	1357/775	874/499	900/514		
	S95	10800							900/514	

			TENSION STRENGTH (1000 POUNDS)							
WT./GRADE		BURST	PIPE BODY	EXLINE	SPEEDTITE	BUTTRESS	TRIPLE SEAL	8 ROUND LT	8 ROUND ST	DRIFT
					7⅝ INCH CASINGS					
26.4	J	4140	564	564/322	577/318	564/322	417/238	378/216	333/190	6.844
	N	6020	752	752/430	744/426	752/430	542/310	439/251		
	S80	6020							520/297	
29.7	N	6890	854	737/421	799/457	854/488	645/369	503/288		6.750
	P	9470	1067	921/527	999/571	1064/609	806/461	661/378		
	995	6890							615/352	
33.7	N	7890	972	806/461	799/457	972/556	742/424	581/332		6.640
	P	10860	1215	1007/516	999/571	1211/692	928/531	750/434		
	S95	7890							731/418	
39.0	N	9180	1119	896/512	799/457	1119/640	794/454	679/388		6.500
	P	12630	1399	1120/641	999/571	1395/798	992/567	885/506		
	S95	9180							877/502	
					8⅝ INCH CASING					
24	J	2950	597						288/165	7.972
32	J	3930	680			680/389	461/264	437/249	392/224	7.796
36	J	4460	775	686/392	738/422	775/443	549/314	499/285	448/256	7.700
	N	6490	1034	916/523	916/523	1034/591	733/419	581/332		
	S95	6490							724/414	
40	N	7300	1156	990/566	1027/587	1156/661	854/488	655/375		7.600
	P	10040	1444	1236/707	1284/734	1425/815	1068/611	858/491		
	S95	7300							840/480	
44	N	8120	1276	1062/607	1027/587	1276/730	956/547	729/417		7.500
	P	11160	1595	1327/759	1284/734	1574/900	1195/684	954/546		
	S95	8120							955/546	
49	N	9040	1412	1062/607	1027/587	1412/808	956/547	812/464		7.386
	P	12430	1764	1327/759	1284/734	1741/996	1195/684	1062/607		
	S95	9040							1078/616	
					9⅝ INCH CASING					
36	J	3520	769					462/264	422/221	8.765
	S80	3520							522/299	
40	J	3950	859	767/439	824/471	859/491	606/346	521/291	477/273	8.679
	N	5750	1145	1022/584	1089/623	1145/655	809/463	606/347		
	S95	5750							744/426	
43.5	N	6330	1256	1022/584	1166/667	1256/718	921/527	670/383		8.599
	P	8700	1569	1278/731	1457/833	1533/877	1150/658	857/490		
	S95	6330							848/485	
47	N	6870	1357	1028/583	1230/704	1357/776	1020/583	727/416		8.525
	P	9440	1696	1352/733	1538/880	1656/947	1276/730	952/545		
	S95	6870							950/543	
53.5	N	7930	1555	1239/707	1230/702	1555/888	1165/665	841/480		8.379
	P	10900	1943	1548/883	1538/878	1943/1109	1456/831	1100/628		
	S95	7930							1118/638	

			TENSION STRENGTH (1000 POUNDS)						
WT./GRADE		BURST	PIPE BODY	EXLINE	SPEEDTITE	BUTTRESS	TRIPLE SEAL	8 ROUND LT	8 ROUND ST	DRIFT
					10¾ INCH CASING					
40.5	J	3130	859			832/475	576/329		450/257	9.894
	S80	3130							535/305	
45.5	J	3580	977	976/557		947/541	695/397		518/295	9.794
	S80	3580							655/374	
51.0	J	4030	1090	1090/622		1060/605	810/463		585/334	9.694
	N	5860	1456	1450/828		1440/822	1080/617		680/388	
	P	8060	1820	1745/996			1350/770		890/508	
	S80	4030							780/445	
55.5	N	6450	1595	1590/909		1578/902	1218/696		750/429	9.604
	P	8860	1870	1870/1069		1870/1069	1523/870		981/561	
	S80	4430							870/497	
60.7	P	9760	2121	1920/1097		2107/1204	1625/929		1031/618	9.504
65.7	P	10660	2367			2289/1308			1180/674	9.408
					11¾ INCH CASING					
47	J	3070	1005			1005/574	781/448		507/290	10.884
	S80	3070							592/338	
54	J	3560	1168			1168/667	956/546		593/339	10.724
	S80	3560							750/429	
60	J	4010	1298			1298/742	1111/635		668/382	10.616
	N	5830	1730			1707/975	1320/754		778/445	
	S80	4010							895/511	
					13⅜ INCH CASING					
54.5	J	2730	1163			1163/665			545/311	12.459
	S80	2730							594/339	
61.0	J	3090	1312			1312/750			613/350	12.359
	S80	3090							739/422	
68.0	J	3450	1459			1459/834			695/397	12.259
	S80	3450							884/505	
72.0	N	5380	2076			2013/1150			868/496	12.191
	S80	3700							950/543	
77	N	5760	2210			2148/1227			930/531	12.119
85	N	6360	2440			2364/1351			1029/588	12.003
					16 INCH CASING					
65	H	1640	1000						423/242	15.062
75	J	2630	1600						662/378	14.936
84	J	2980	1805						753/430	14.822
109	J	3950	2370						1003/573	14.500
118	N	6260	3430						1273/727	14.382
					20 INCH CASING					
94	H	1530	1620						487/278	18.936
133	J	3050	2905						948/542	18.542
60	J	4010	1298						950/543	
	S80	3560				2148/1227			868/496	12.191
61.0	J	3090	1312							